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Progress in the Reclamation of Alkali Lands - - - - - - - - - - *J. C. Marr et al*

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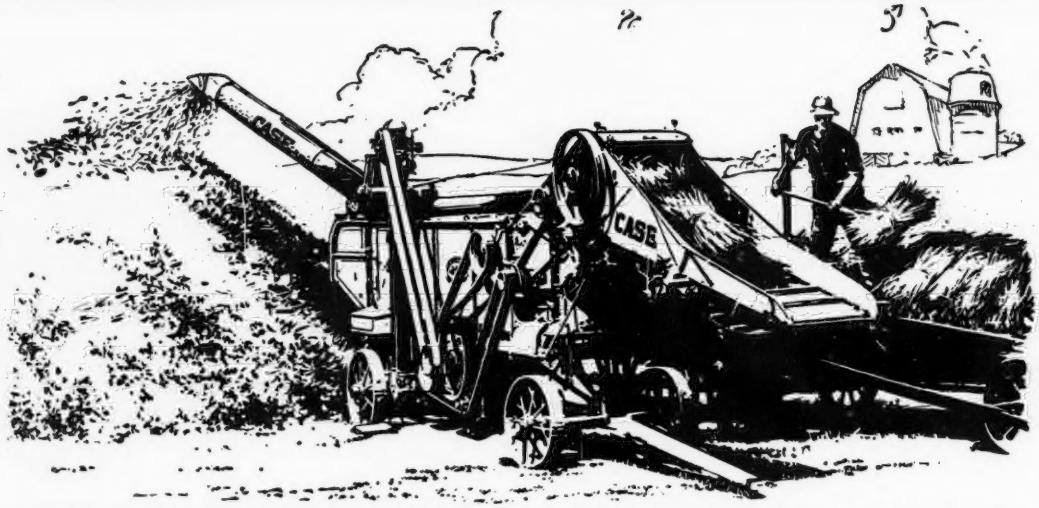
Mechanical Power Revolutionizing Agriculture - - - - - - - - - *E. A. Stewart*



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WILLIAM BOSS, President — RAYMOND OLNEY, Secretary-Treasurer

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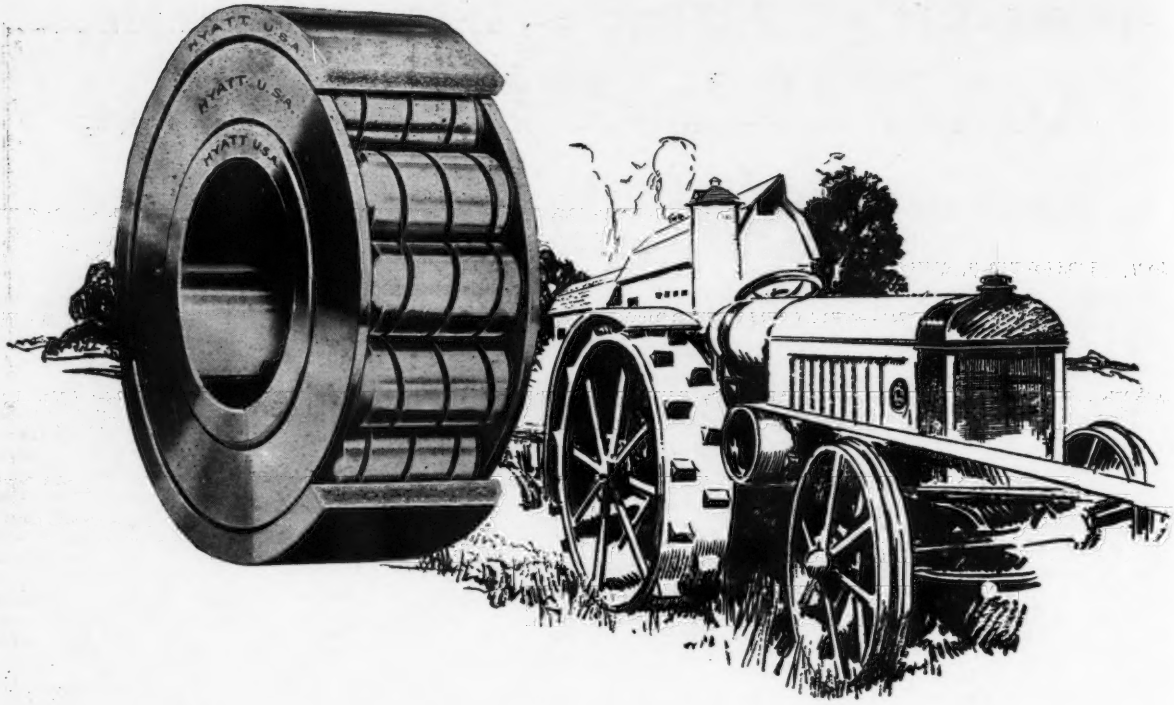

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AGRICULTURAL ENGINEERING

Vol. 9 NOVEMBER, 1928 No. 11

Plowing Draft Tests on Fertilizer Plots[1]

By D. B. Lucas[2]

DURING a period of more than twenty years the soil chemistry department of the New Jersey Agricultural Experiment Station has studied fertilizer effects on the same series of plots. Forty of these small areas have received the same individual fertilizer treatments more or less constantly over the entire period while the yields of the several crops in the rotation have been compared. Twenty of the plots received applications of lime at intervals of five years while the other twenty remained without lime. Obvious differences in the physical condition of the soil were observed during the conduct of this prolonged investigation, and were particularly apparent in the plowing operation. Prof. A. W. Blair, soil chemist, became interested in making tests of the draft required for plowing these various plots and asked for the cooperation of the agricultural engineering department in the securing of dynamometer records. As a result the records were made in the spring of 1928. A Szekely recording traction dynamometer, loaned by the rural engineering department of Cornell University, was used and will be described later.

It should be noted early in the discussion that there are three important variables which had to be dealt with simultaneously, and which complicated the interpretation of the results. The reader will therefore be forewarned of the caution necessary in drawing useful conclusions from the data. The primary variable is, of course, the direct effect on the physical condition of the soil resulting from differences in amounts and kinds of fertilizers and the presence or absence of lime. The history of the treament of each plot is accurately known. Second, as a result (it is assumed) of this difference in treatment there are variations in the crop yields and root growth. The yields are known, but the root conditions and especially their effects on plowing draft are difficult of observation. Thus the third variable, the plowing draft, is affected by the complete soil condition resulting, perhaps, from both the treatment and the ensuing effect on root development. It would appear that the soil which is in a condition most favorable to plant growth would produce a corresponding root system, which makes difficult the observation of draft variations caused directly by the treatment. Furthermore, the elimination of the root variable, by preventing plant growth for a period, would create an abnormal and hypothetical situation of perhaps less value. At any rate, it would seem best to take account of all important conditions in evaluating the results of the present study.

The experimental plots have parallel sides 33.36 feet by 65.87 feet and each constitutes 1/20 of an acre. The total area is enlarged to include a space 4 feet wide between plots. It was necessary to plow several plots in addition to those considered in the results, making a total of 54. The area studied is so arranged that the width includes the long dimension of two plots. The length accommodates the short dimension of 27 plots besides the intervening spaces. In plowing the whole field lengthwise the trip one way covered one set of 27 plots with a return on the other side over the other 27 plots. The draft for plowing each plot was recorded once every round trip. The records were repeated eight times and averaged for each separate area. Only 40 of these average draft records were useful in this study.

The detailed differences in the fertilizer treatments for the various plots appear with the tabulated data. A wide range of fertilizer and manure applications was used and the untreated areas will serve as a partial check. Perhaps the most interesting factor in the treatments is the use of limed and unlimed plots with each variation in fertilizer. This gave an excellent opportunity for the observation of the effects of lime on plowing draft under a variety of conditions. The crop rotation consists of corn, oats, wheat and two years of timothy. The last crop grown on all of the plots before the plowing tests was timothy hay. The roots of the hay crop were by no means entirely decomposed before the spring plowing.

The dynamometer was mounted with the cylinder (Fig. 1) in the line of draft. The cylinder contained a light grade of lubricating oil which was subject to pressure as the direct result of the draft. The amount of this pressure was conveniently measured in total pounds of draft and marked on the record by the apparatus shown in the case. Distance was measured by the ground wheel whch turns the draft record. A clock mechanism indicates the position of the plowing outfit at intervals of one minute. Fig. 2 shows the testing outfit in the field.

[1]Paper of the journal series of the New Jersey Agricultural Experiment Station, Department of Agricultural Engineering. Released for first publication in AGRICULTURAL ENGINEERING.

[2]Associate professor of agricultural engineering, Rutgers University. Assoc. Mem. A.S.A.E.

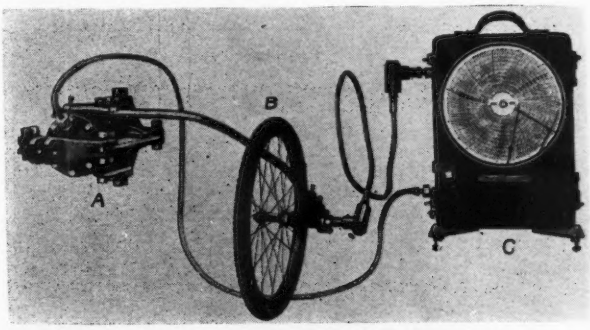


Fig. 1. The assembled Szekely hydrostatic dynamometer, showing (A) the cylinder, (B) the land wheel and (C) the recording apparatus in their relative positions

Fig. 2. The testing outfit used in the New Jersey plow draft tests

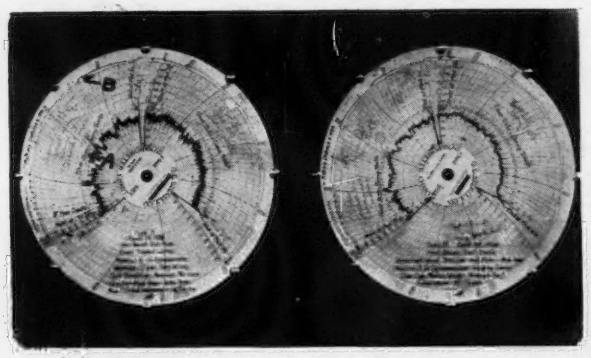


Fig. 3. Two sample charts showing (A) the draft record and (B) the distance record. It may be noticed that the draft record on the chart at the left is much wider than on the second chart. This is due to the use of a lighter grade of oil for the first record, making the dynamometer more sensitive and increasing the range of activity of the recording indicator. The original penciled notes are visible but have been reprinted in ink for convenience in reading

Fig. 3 shows two sample records with explanatory notes. The heavy, irregular line, made by the draft indicator, shows the pounds of force exerted on the drawbar throughout the run. A chart is divided into 54 parts, each representing the draft record for one plot. The average draft for each plot was estimated from the chart according to the manufacturer's instructions. There were eight estimates for each plot and these were averaged to obtain a final measure of the draft.

The record of the distance traveled is shown in Fig. 3 on the outer edge of the chart. The notches in this line represent intervals of one minute. All of the records were taken with plowing speeds of 2½ and 3 miles per hour. This was found to check with the rates of travel recorded on the charts. It is necessary to use a factor of 0.444 in computing distances.

Most of the testing was done on a plowing outfit made up of a Case 12-20-hp. tractor and Case plow having two 14-inch bottoms. The plow bottoms were of the general-purpose shape and were operated at a depth of 8 inches. The work was completed with a McCormick-Deering 10-20-hp. tractor and plow. The results for the two plows were so much alike that the former data were used entirely for analysis. The summarized data are shown in the accompanying table.

The variations in the results are so intricate that it is difficult to draw workable conclusions from a glance at the data. For that reason statistical methods were employed in the hope of finding some facts of importance. It appeared that greater draft was used for plowing the plots having the higher yields. In order to learn the relationship between

Fig. 4. Showing irregularities in the plowed furrow due to sudden changes in draft. The extreme curve at A is caused by the low draft of unlimed Plot 11. The fertilizer treatment for this plot has allowed it to become so acid that timothy will not grow. Instead a heavy growth of crab grass came up in the fall of 1927, but the sod was lighter than for timothy

yield and draft the Pearson coefficient of correlation, r, was computed. Pearson suggested the formula

$$r = \frac{\Sigma\, x\, y.}{N \cdot \delta x \cdot \delta y},$$

but the form for simple series was used where

$$r = \frac{\Sigma\, x\, y - \dfrac{\Sigma\, x \cdot \Sigma\, y}{N}}{\sqrt{\left[\Sigma\, x^2 - \dfrac{(\Sigma\, x)^2}{N}\right]\left[\Sigma\, y^2 - \dfrac{(\Sigma\, y)^2}{N}\right]}}$$

x and y are the variables, N is the number of cases and δ is the standard deviation. The correlation value found is +0.54. This indicates a marked relationship though not high. It could be assumed then that there is a tendency toward difficult plowing following a high yield, presumably caused by heavy root development. The correlation would seem low enough, however, to allow the possibility that other factors than yield are related to the plowing draft.

The last two columns in the table show the differences between yields and draft for the limed plots as compared with those not limed. It is apparent that, in accordance with much other experimental data, the yields for the limed soils are increased in the great majority of cases. In contrast, the draft was higher for the unlimed plots in the majority of cases. To be exact there were six cases where the un-

Results of Plowing Draft Tests

Plot No.	Fertilizer Treatment for 1/20-acre Plot	Limed Plots		Unlimed Plots		Differences (limed—unlimed)	
		Yield 1927	Draft	Yield 1927	Draft	Yield	Draft
1	Nothing	617	858	638	960	—21	—102
2	16 lb. KCl (8 lb. after 1923)	869	825	726	870	143	—45
3	32 lb. acid phosphate (16 lb. after 1923)	623	850	793	970	—170	—120
4	*Minerals only (Combination of 2 and 3, also changed in 1923)	2,102	850	471	920	1631	—70
5	Minerals + 1600 lb. cow manure	3,824	858	7,516	1010	—3692	—152
6	Minerals + (1600 lb. horse manure previous to 1923)	2,547	875	2,942	920	—395	—45
7	Nothing	1,037	858	118	680	919	178
8	Minerals + 8 lb. $NaNO_3$	2,998	867	1,711	870	1287	—3
9	Minerals + 16 lb. $NaNO_3$	4,177	842	4,699	940	—522	—98
10	Minerals + Ca $(No_3)_2$ equivalent to 16 lb. $NaNO_3$	4,368	892	4,325	960	43	—68
11	Minerals + $(NH_4)_2$ SO_4 equivalent to 16 lb. $NaNO_3$	3,888	892	2,150	740	1738	152
12	Minerals + Ca CN_2 equivalent to 16 lb. $NaNO_3$	3,528	892	3,323	950	205	—58
13	Minerals + (Dried blood equivalent to 16 lb. $NaNO_3$ previous to 1923)	2,303	883	1,130	880	1173	3
14	Minerals + $NaNO_3$ + $(NH_4)_2$ SO_4 equivalent to 16 lb. $NaNO_3$	4,431	900		960		—60
15	Minerals + tankage equivalent to 16 lb. $NaNO_3$	2,924	900	2,081	792	843	108
16	Minerals + (200 lb. alfalfa hay previous to 1923)	3,055	900	954	858	2101	42
17	Minerals + (200 lb. straw previous to 1923)	6,287	975	578	883	5709	92
18	Minerals + 16 lb. $NaNO_3$ + 1600 lb. cow manure	7,867	983	7,232	1017	635	—34
19	Minerals only	4,110	842	579	792	3531	50
20	Minerals + 16 lb. $NaNO_3$ + 200 lb. rye straw	4,417	833	4,586	842	—169	—9

*Minerals—16 lb. of superphosphate and 8 lb. of muriate of potash.

limed plots yielded higher and in each case the draft was higher. But there were 13 cases where the limed plots yielded higher and yet for six of these pairs the draft was greater for the unlimed plot. This shows that the draft was always greater for the unlimed soils where the yield was also greater, and for about one-half of the unlimed plots where the yield was smaller. It would seem, therefore, that there is a tendency toward a decrease in plowing draft for limed soils, especially where yields are not greatly increased.

There is considerable variation in draft for the individual fertilizer treatments. However, the amount of the correlation between draft and yield would tend to cancel the value of conclusions based on only one or two plots having the same treatment. A repetition of the draft tests over a series of years may reveal some of the more extreme differences. By inspection of the table it appears that the use of manures, straw and hay may tend to increase draft, more than other fertilizers for the same yield. Plots 5, 6, 16, 17, 18 and 20 have such treatment. The fact that there were large variations in the ease of plowing was very obvious in the field. Fig. 4 shows the irregularity of the plowed furrow, which was largely the result of sudden changes in plowing resistance.

CONCLUSIONS

1. Plowing draft tends to increase as the yield increases. This may be the result of
   (a) Heavier root development
   (b) More resistance to the plow by soils of higher fertility. (The opposite seems more likely, especially where lime is the variable, as brought out in the next conclusion.)

2. It appears that the draft required to plow limed soils is less than for unlimed soils. This seems true, not only when yields are assumed to be equal, but even in spite of the normal higher yields following the liming of acid soils, and the probable increase in root development. Under the conditions of the tests it would seem that lime, over a period of years, made the physical condition of the soil more favorable to plowing.

3. Draft is increased more for certain fertilizer treatments (see the tabulated data) than for others. The coefficient of correlation between yield and draft indicates that other factors than yield may influence the draft. It appears that lime has an effect favorable to draft. The same may also be true of certain fertilizers, but the direct effect is not clearly revealed in the results of this study.

AUTHOR'S NOTE: The author is indebted to Prof. A. W. Blair, soil chemist, New Jersey Agricultural Experiment Station, who made the experimental plots available for the draft tests and furnished photographs of the field work. Prof. Blair has had charge of the field experiments for the last sixteen years. Credit is also due to R. A. Diehm, who has conducted the field work for the past two years, for his constant help in obtaining the draft records.

Farm Leased for Studying Soil Erosion Control

WITH the object of solving the many practical problems in connection with the prevention of soil erosion and the restoring of lands already eroded, the Bureau of Public Roads, U. S. Department of Agriculture, working in cooperation with the Guthrie (Oklahoma) Chamber of Commerce, has begun a large-scale study of the whole subject of terracing. The Chamber of Commerce has leased a 150-acre farm which the division of agricultural engineering of the Bureau will operate as a going farm.

The section in which the farm is located has suffered extensively from erosion and the tract acquired for test purposes has cultivated fields that have already been affected. Other portions that have been used for pasture are not affected. The farm will be terraced in strict accordance with the requirements of soil and slope. The results will be closely observed and run-off and erosion measured, and such changes in location and dimensions of terraces will be made, from time to time, as seem advisable until the best possible layout is secured. All this will be done under actual conditions of cropping, cultivating and harvesting, including the use of modern farm machinery.

The farm is located about 4 miles south of Guthrie and presents soil and topographical characteristics that are typical of large areas in Oklahoma and adjoining states where erosion by rain water is very active and already has caused enormous losses of cultivable land. The project will constitute a practical demonstration of terracing methods and results and is expected to yield information of great values.

An Omission

THE accompanying table was omitted through error from the article, entitled "Problem Factors in the Distribution of Some Nitrate Fertilizers," by D. B. Lucas, which appeared on page 317 of the October issue of AGRICULTURAL ENGINEERING (Vol. 9, No. 10). It gives the results of tests by the New Jersey Agricultural Experiment Station, comparing as to distribution qualities a pure, dry, free-flowing nitrate with both coarse and fine common nitrate.

The tests were made using four representative distributors. The first, a common, finger force-feed type; the second and third, special force-feed types controlling the rate of feed by variable openings; and the fourth, a semi-force-feed type in which gravity plays a large part. The overrun given is the percentage of variation from the expected weight according to the calibration. It indicates the difference in the distribution qualities of the nitrates tested.

Setting	Lb. per Acre at 2 lb. per quart	Fraction of acre	Weight expected	Common $NaNO_3$ (2 lb. 5 oz. per qt.) (Texture of coarse salt, very damp)			The New $NaNO_3$ (2 lb. 5 oz. per qt.) (Grain about 2X size of alfalfa seed, not sticky)				Extra Finely Pulverized $NaNO_3$* (1 lb. 13 oz. per qt.) (Texture of table salt or finer, very damp)		
				Actual weight	Corrected weight	Per cent Overrun	Actual weight	Corrected weight	Per cent Overrun	Actual wt. per acre	Actual weight	Corrected weight	Per cent Overrun
INTERNATIONAL HOOSIER GRAIN DRILL													
1-Slow	30	1/4	7 lb. 8 oz.	14 lb. 0 oz.	12 lb. 1 oz.	+ 61	11 lb. 8 oz	9 lb.11 oz	+ 29	46 lb. 0 oz.	Would not feed self		
5-Slow	45	1/4	11 lb. 4 oz.	14 lb. 8 oz.	12 lb.8 oz.	+ 11	16 lb. 8 oz	13 lb.14 oz	+ 23	66 lb. 0 oz.	4 lb. 8 oz.	4 lb.15 oz.	- 55
5-Fast	220	1/10	22 lb. 0 oz.				26 lb. 8 oz	22 lb. 5 oz	+ 1	265 lb.0 oz.			
16-Slow	125	1/10	12 lb. 8 oz.	15 lb. 0 oz.	13 lb.0 oz	+ 4	20 lb. 6 oz.	17 lb 2 oz	+ 37	203 lb.12 oz.	(1/4 acre) 15 lb.8 oz	Hand-fed 17 lb.2 oz	- 43
16-Fast	610	1/40	15 lb. 4 oz.				23 lb. 6 oz	19 lb.11 oz	+ 29	935 lb. 0 oz			
23-Fast	915			Does not pour out at any setting				Ran steady			Does not pour out at any setting		
ASPINWALL POTATO PLANTER										Ratio**			
Hole 1		25 turns		5 lb. 8 oz.			20 lb. 8 oz.			3.8			
Hole 3		25 turns		22 lb. 14 oz.			39 lb.12 oz			1.7			
Last Hole 6		25 turns		31 lb. 8 oz.			48 lb. 8 oz.			1.5			
BLACK HAWK CORN PLANTER													
Hole 1		25 turns		12 oz.			2 lb.15 oz			3.9			
Hole 2		25 turns		5 lb. 12 oz.			9 lb 0 oz.			1.6			
Hole 3		25 turns		8 lb. 14 oz.			10 lb.12 oz.			1.2			
POMMERANIA DISTRIBUTOR													
				Does not pour out at any setting			Runs at smallest setting						

* A very fine-textured common nitrate
** Ratio = ratio of pounds of new nitrate to pounds of common nitrate.

The Reclamation of Alkali Lands[1]

RECLAMATION of alkali land after drainage has constituted one of the major projects of the A.S.A.E. Committee on Drainage of Irrigated Lands for the past two years. Though several members of the Committee are actively engaged in or are closely associated with work of this character, the present status of the alkali land problem rests upon the combined efforts of many workers in this and foreign lands and covers a period of intensive study of ten years or more. In the remarks which follow it will be understood that the present members of the Committee assume only a small portion of the responsibility for the progress which has beer made in combating this most difficult agricultural problem.

One year ago at this time the Committee faithfully and accurately described the situation in its annual report[2] and in a special paper[3] on the subject. It will be recalled that a wide variation was cited in the chemical and mechanical condition of alkali land. It was pointed out that little difficulty is experienced in leaching soils free of alkali when the soil is porous and well drained and when the alkali consists largely of calcium salts. Likewise, when the soil consists of sodium salts and the irrigation water is high in soluble calcium, the alkali can be successfully leached out. Doubt was cast upon the feasibility of reclaiming alkali land when the soils are of the heavier, more impervious types and when the ameliorating agent, soluble calcium, in sufficient quantity, is absent. The latter condition was noted as being the most prevalent.

When considered alone from the standpoint of practical results, little progress has come out of the year's work. Indeed doubt has crystallized into belief, in some quarters, that adverse types of alkali land are not worth the cost of reclamation. Recently this view of the situation has been taken in connection with the Vale Irrigation Project, in which case practically all of the alkali land was eliminated from the project; and by Drainage District No. 1, Gem County, Idaho, in which case the badly alkaline land was deemed worthless and was not assessed for benefits. This more or less generally accepted opinion is perhaps justified at the present time.

Notwithstanding this discouraging aspect of alkali land reclamation, there exist live possibilities that practical means may yet be found for correcting the worst of these lands. Results so far procured from experiments now in progress have not yet been sufficiently verified to justify confidence in our ability to economically reclaim all alkali land, but there is no reason found for abandonment of the project, nor for discouragement regarding the possibility of satisfactorily solving the problem. The following statements of some of the work of this character now in progress will serve best to illustrate this viewpoint:

Alkali Reclamation in California. The principal alkali reclamation work done in California during 1927-28 consists of two experimental plots in Los Angeles County. One, on the county farm at Downey, represents an area typical of several thousand acres in the lower portion of Los Angeles and Orange Counties. The soil is sandy, in fact, it is mapped as Hanford sand and in some places is underlain with a loose coarse sand at about 6 ft.

In spite of its sandy nature, the soil on this farm bakes hard and intractable after each irrigation or rain. The water-table is maintained at about 6½ ft. below the surface by a tile drainage system. The soil is heavily charged with black alkali and for the most part is devoid of vegetation. What little vegetation there is consists of patches of Bermuda grass and alkali weed.

Four checks of this field were carefully leveled and diked and treated as follows:

Check No. 1—Sulphur at the rate of 1000 lb. per acre plus manure at rate of 40,000 lb. per acre.

Check No. 2—Sulphur at the rate of 1,000 lb. per acre plus gypsum at rate of 4,000 lb. per acre.

Check No. 3—Iron sulphate at the rate of 3,000 lb. per acre.

Check No. 4—Untreated.

Treatment was applied on March 7, 1927, and each check was kept lightly cultivated and moist throughout the summer. In the late fall the area was flooded and kept under water for several days.

Upon drying out, Check No. 1, that on which sulphur and manure had been applied, appeared to be in much the best physical condition with the sulphur and gypsum plot (No. 2) being only slightly inferior. Alfalfa was planted on all four checks in January, 1928. On Check No. 1 the stand was excellent and of good color; on Check No. 2 the stand was good over most of the area, while on Check No. 3 the stand was very poor and the color not good. So far as could be observed, no seed whatever came up on Check No. 4

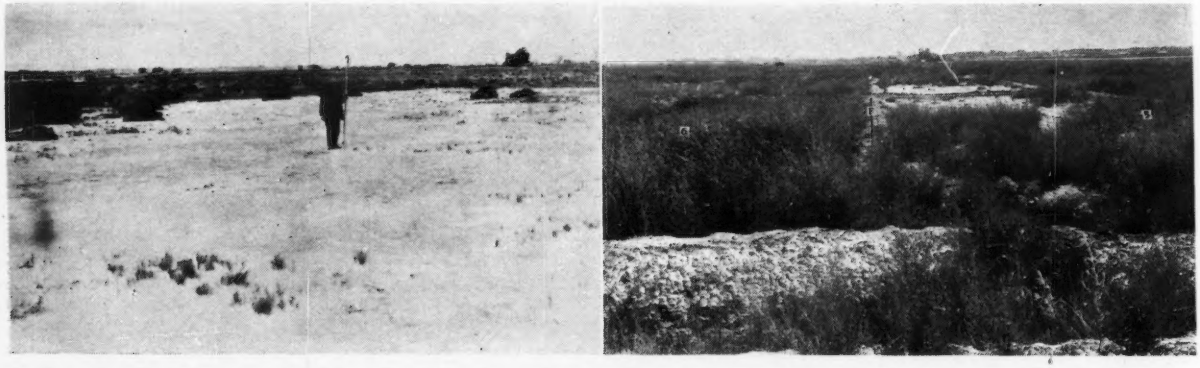
Four more plots adjoining those mentioned were laid out and treated as follows in April, 1928; these have not yet been planted.

Check No. 5—Sulphur 1,500 lb. per acre plus manure 40,000 lb. per acre.

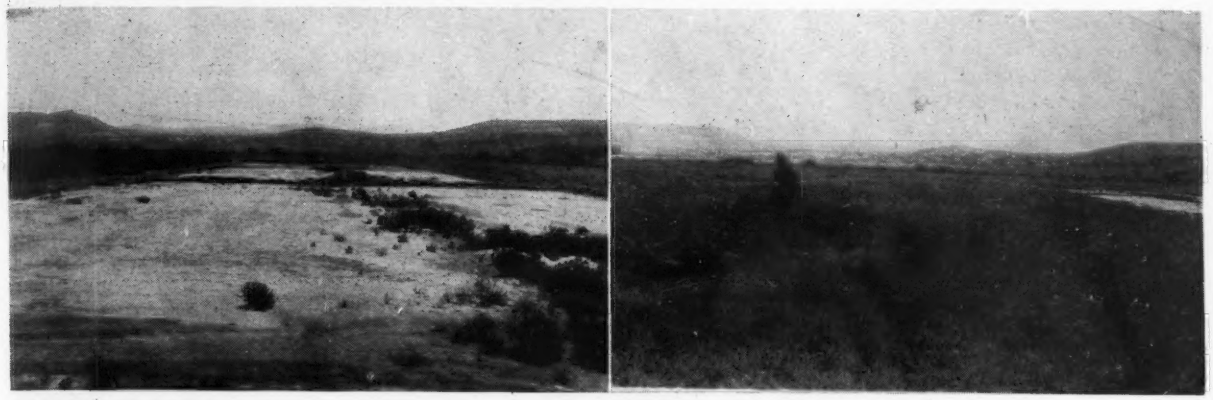
[1]1927-28 report of the Committee on Drainage of Irrigated Lands of the American Society of Agricultural Engineers.

[2]1926-27 report of the Committee on Drainage of Irrigated Lands of the American Society of Agricultural Engineers. A.S.A.E. Transactions—Vol. 21 (1927).

[3]"The Reclamation of Alkali Land," by J. C. Marr. A.S.A.E. Transactions—Vol. 21 (1927).



(Left) Appearance of land on the Caldwell (Idaho) alkali experimental tract in 1926 prior to starting experimental work. (Right) Same location as that shown at the left, two years later. Plot F-5 received no treatment other than cultivation, irrigation, and seeding. As may be seen, the plot is almost bare of crops and the soil is hard and contains a high percentage of alkali. Plot F-6 (to the left of the picture) was treated with C_aSO_4 at the rate of 15 tons per acre during 1926. A fair crop of sweet clover resulted after two years of cultivation, irrigation, and seeding. The quality of soil, both physically and chemically, shows marked improvement, though complete reclamation has not yet been accomplished



(Left) This picture shows the appearance of an untreated plot on the Vale (Oregon) alkali experimental tract after seven years cultivation and irrigation. All efforts to get a crop to grow on this plot have failed. (Right) This plot adjoins that shown at the left. Four tons of manure per acre had been applied during each of the past four years, and seven and one-half tons per acre of sulphur were applied two years ago. The soil has been greatly improved and a good crop of sweet clover is being produced at the present time. This experiment shows there is virtue in the application of sulphur and manure though the cost is too great for general use

Check No. 6—Gypsum 50,000 lb. per acre.

Check No. 7—Sulphur 2,000 lb. per acre plus 20,000 lb. manure per acre.

Check No. 8—Sulphur 2,000 lb. per acre plus lime 2,000 lb. per acre.

The second alkali reclamation experiment in Los Angeles County was near Lancaster in the Mojave Desert. The treatment on four checks of Sunrise sand was similar to that at the county farm. On this tract the sulphur plus manure check was outstanding. However, the sulphur plus gypsum check produced a good stand of alfalfa. Alfalfa failed to germinate on the iron sulphate or the untreated check, and the soil became very hard and compact. The soil on the first two checks was loose and mellow, and irrigation water penetrated freely. Neither the county farm nor the Lancaster experiments are far enough along to measure the yields.

A continuation of experiments on field trials with rice in Imperial Valley confirm previous indications that alkaline areas on which rice is grown are in better condition afterwards than where a like amount of water is applied without growing rice. There is a very great advantage also in that it has been possible to induce a number of farmers to plant and irrigate rice, whereas it is very difficult to get them to keep water on the land a sufficient length of time if there is no crop growing. This is true in spite of the fact that probably none of the badly alkaline areas produced a profitable yield of rice the first year. The areas which were in rice in 1926 and planted a second time in 1927, produced a better crop of rice than any first-year plantings on soils where the alkali was present in quantity sufficient to prohibit the growth of ordinary crops.

Alkali Reclamation in Idaho. The alkali work being carried on in Idaho consists of two experimental tracts, one in the vicinity of Banida in the south central portion of the state and the other near Caldwell in southwestern Idaho. The two tracts are widely different. The Banida area represents irrigated land in which salt accumulated very rapidly and for which drainage was provided very shortly afterwards. The Caldwell tract has been alkaline and virtually worthless as far back as its history is known.

The alkali in the vicinity of Banida consists chiefly of chlorides and sulphates. With the removal of these salts a carbonate content developed and with it a partial deflocculation of the soil; however, this condition has not interfered with the tillage of the soil when proper irrigation and cultivation have been maintained throughout the period.

The experimental plots consist of twelve one-half-acre checks which were treated with varying amounts of sulphur and gypsum in 1925. The results thus far obtained do not show a direct benefit so far as crop production is concerned, but a difference in favor of the chemically treated plots is shown in the subsequent development of carbonates.

With these experiments there appears to be some doubt as to the efficiency of the drainage system, which may explain the slowness, or failure of chemical treatments to remedy the soil defects. The tract is served by a tile drain placed at a depth of five feet. In addition to its being quite shallow, it has a tendency to clog.

The Caldwell experiments are being conducted on alkali land of the worst sort. The soil consists of river bottom land which has been classified as Caldwell loam and later correlated with Elsinor series. It is of a deflocculated, relatively impervious, strongly alkaline, unproductive type. In some spots an alkalinity equivalent to as high as 4,800 parts per million of normal carbonate is found. Of this as much as 500 parts per million may occur as hydroxide.

The tract is served by a deep open drain averaging 8 ft. deep. The normal groundwater level is held to a depth of from 5 to 8 ft., but immediately following irrigation a "perched" water level is created due to the presence of an impervious layer of subsoil from 18 to 30 in. below the surface. The continued presence of this upper water level, or supersaturated soil zone at a number of points throughout the tract renders the present drainage system ineffective. Apparently the impervious nature of the soil rather than faulty construction or location of the drainage system is responsible for this condition.

A variety of experiments including the application of chemicals, manure and straw, blasting, subsoiling, supplementary drainage, and the planting and care of adaptable crops have been conducted with a view to improving the permeability of the soil and leaching out the alkali. Though subsequent developments may radically alter present indications, it now appears that the greatest progress made in improving the soil has resulted from the planting and care of especially adapted crops. Special methods of preparing the land for seeding and handling the crop have resulted in successfully cropping areas where previously nothing had grown. The crops thus started have continued to do well throughout 1926-27-28, and the soil has improved both chemically and physically. Of the crops employed sweet clover was found best adapted to the conditions. The greatest success in starting the crop was obtained with winter seeding on on uncleared land, or on land first covered with a well-decomposed layer of manure.

Alkali Reclamation in Utah. The principal work done on the action of alkali on crops and soils in Utah during the past two years consists of laboratory experiments.

In a study of the influence of alkali salts and especially of the dispersability of soil singly saturated with calcium, magnesium, potassium and sodium a leaching experiment was carried on with the idea of saturating with calcium, at the beginning of the leaching process, a soil which was to a greater or less degree saturated with sodium, by the application of soluble calcium salts. Calcium sulphate was used and moderate results obtained from the leaching, but the action was slow. Calcium chloride has been used with remarkable results. The rate of flow from a tank of soil three feet in height and one foot in diameter has been increased from a few cubic centimeters per hour to one hundred or more per hour by treatment with a calcium chloride solution. Difference could be noted in the rate within forty-eight hours and very remarkable differences within a week.

Work is now being done on minimum quantities of calcium

(Left) At least a portion and perhaps the major part of the difficulty being experienced in reclaiming alkali land may be charged to faulty drainage. Most gravity drains become clogged with vegetation, but even when kept clean lower the ground water level an insufficient amount to afford efficient drainage. (Right) Drainage by pumping from wells results is efficient drainage at all times. Their use has resulted in rapid reclamation of alkali land. It is believed that after all efficient drainage is the most important requirement for economical reclamation of alkali land

chloride that might be used in the reclamation of alkali soils.

No field experiments are reported as having been carried on in Utah in which calcium chloride has been used; however, such an experiment is in progress at the Caldwell experimental tract, Idaho. In this instance calcium chloride was applied at the rate of 12,560 lb. per acre during July 1926. During the remainder of that season and during 1927 the treated plot was irrigated. During the fall of 1927 sweet clover was planted and during the early spring alfalfa was also planted. It is still too early to ascertain what the result might be so far as the crop is concerned, but chemical analyses of the soil from this plot, and a superficial examination of its mechanical condition indicates that about the same amount of improvement has taken place as with plots treated with sulphur, sulphuric acid, and gypsum.

Another and newer aspect of the alkali work being conducted in Utah is an attempt to determine the activity or degree of ionization of the replaceable bases of the soil. It is felt that there may be a relationship between the dispersion of the soil and the activity of the various bases which that soil carries in a replaceable condition.

Alkali Reclamation in Oregon. Intensive study of alkali reclamation has been made in Oregon both in the laboratories of the state agricultural college and on a field experimental tract located near Vale, Oregon.

Though a number of treatments, including the application of sulphur and gypsum, have been given a trial on the Vale tract, so far none have yielded as good results as obtained from seeding pasture mixtures on uncleared land followed by copious irrigation. The usefulness of this method depends, of course, on whether it is physically possible to irrigate without first altering the surface of the ground.

The conclusion which appears to have been drawn from the Vale experiments is that no practical method has yet been developed for handling these lands. As previously stated the view has been taken in connection with the Vale irrigation project to eliminate all of the badly alkaline lands from the project. The type of alkali land in this instance is adverse in character, however, in some ways it is preferable to that encountered at the Caldwell, Idaho, tract.

Alkali Reclamation in Arizona. The most recent alkali reclamation results procured in Arizona include those from an experiment station in the Yuma Valley.

The soil in this instance is reported to have contained an enormous quantity of alkali, amounting to nearly 2 per cent of the weight of the soil. Furthermore, more than half of these salts were sodium salts. The land is described as having been a most difficult problem in reclamation. The drainage is described as fairly satisfactory, the groundwater level ranging in depth from 8 to 10 ft.

During the first week of March, 1925, the land was plowed and carefully leveled. Borders were then constructed around all of the poor areas, manure disked under at the rate of 20 tons per acre, except on the "no manure" plots, and the whole given two leachings totaling about 100 hr. to remove as much of the white alkali as possible. The field was then divided into three irregular areas of seven plots each and the following treatments given:

1. Check—nothing
2. One ton of calcium chloride per acre
3. One ton of calcium chloride per acre plus manure
4. Two tons of gypsum per acre
5. Two tons of gypsum per acre plus manure
6. Three tons of gypsum per acre plus manure
7. Manure alone.

Before giving the first leaching, the manure had been added by mistake except to the "no manure" plots. Accordingly at this time, only the calcium chloride and gypsum were applied and disked in as deeply as possible. From this time until December 1925, when barley was planted, all of the plots were heavily leached.

Conclusions reached on April 17, 1926, when the grain was harvested, were as follows: The check plots gave the lowest yields. The highest yields usually were secured where one ton of calcium chloride and 20 tons of manure were used together. The other treatments gave yields intermediate between these two extremes. Little difference was shown between the 2 and 3-ton gypsum applications. Twenty tons of manure were almost as effective alone as where used in conjunction with either calcium chloride or gypsum.

From May 10, 1926, until November 17, 1926, when alfalfa was planted, the land was alternately heavily leached and cultivated. A heavy, uniform growth of alfalfa was procured over the entire area although the check plots which received no manure produced the lightest yields. The last series of soil samples which were drawn on April 20, 1927, showed that over 350,000 lb. of salt had been removed from the surface 6 ft. of soil of each acre of this land. As late as January 3, 1928, no deterioration in these plots could be detected and excellent crops of alfalfa were being produced.

A second activity of the Committee has been the preparation of a bibliography of publications relating to the general subject "Drainage of Irrigated Lands." This work has been in progress for two years. Though the project is well under way the expected progress has not been made owing to the fact that we have been seriously handicapped because of the lack of library facilities. It appears desirable that the time and attention which has been given this matter should not be lost and that arrangements should be made during the coming year to push this work to conclusion.

It is apparent that both of the major undertakings of the Committee will require further work before a final report can be made. Therefore, it is recommended to the Committee on Drainage of Irrigated Lands for the year 1928-29 that these projects be included in their activities.

Respectfully submitted,

COMMITTEE ON DRAINAGE OF IRRIGATED LANDS

James C. Marr, Chairman — Walter W. Weir

L. T. Jessup (Advisory) — M. R. Lewis

Experiments Prove Value of Grinding Feed

By Truman E. Hienton[1]

EXPERIMENTS have been conducted in many states to determine the difference in the feeding value of ground and whole grains. Grinding experiments have been conducted in several states to determine power required and capacity of different feed grinders. Animal husbandry men and agricultural engineers have been working along independent lines without proper cooperation in this matter. Agricultural engineers at Purdue University, however, have gotten together with the dairy and animal husbandry departments during the past few years and several cooperative investigations have been started and a few completed.

The grinding of grain for dairy cattle has been a rather generally accepted fact, but no authoritative information was available until recently regarding the exact degree of fineness. Results obtained from a feeding and grinding experiment conducted in 1925 and 1926 by the dairy and agricultural engineering departments of Purdue University show that grinding the whole grain in the ration increases production 8.5 per cent, but that excessively fine grinding does not pay for the extra cost.

The feeding experiment consisted of feeding twenty cows, divided into lots of five each, for an experimental period of eighty-four days. Four separate grain mixtures were fed the first in which corn and oats fed were whole, the second in which the corn was merely cracked and the oats crushed, the third in which corn and oats were both ground medium fine, and the fourth in which oats and corn were both pulverized. The grinder used was of the hammer type, and the following sizes of screens were used: Cracked corn, 11/16 inch; crushed oats, 7/16 inch; medium fine corn, ⅛ inch; medium fine oats, ¼ inch; pulverized oats and corn both, 1/32 inch. The following table shows the results of this test:

	Whole grain	Cracked or crushed grain	Medium ground grain	Pulverized finely ground grain
Milk production	8,975.1 lb.	9,524.1 lb.	10,114.3 lb.	9,564.3 lb.
Returns above cost ..	$54.23	$65.03	$77.06	$53.50
Cost per 100 lb. of milk	1.39	1.32	1.24	1.44

The power cost shown is for one mill only, with cost of power figured at 7 cents per kw-hr. Power costs of grinding have been determined for several other mills, but the costs shown are those for the mill used during the experiment.

A second experiment which has proven that grinding grain returns a profit above its cost, was completed in September of this year. This experiment was concerned with the determination of the value of grinding oats for growing hogs and the most economical degree of fineness. Whole oats were compared with coarsely ground, medium finely ground, and very finely ground oats. The ground oats used in the experiment were ground with a small motor-driven hammer feed grinder. The coarsely ground oats were ground on a ¼-inch screen, the medium fine on a ⅛-inch screen and the very fine on a 1/16-inch screen. The power required per hundred pounds for each fineness was as follows:

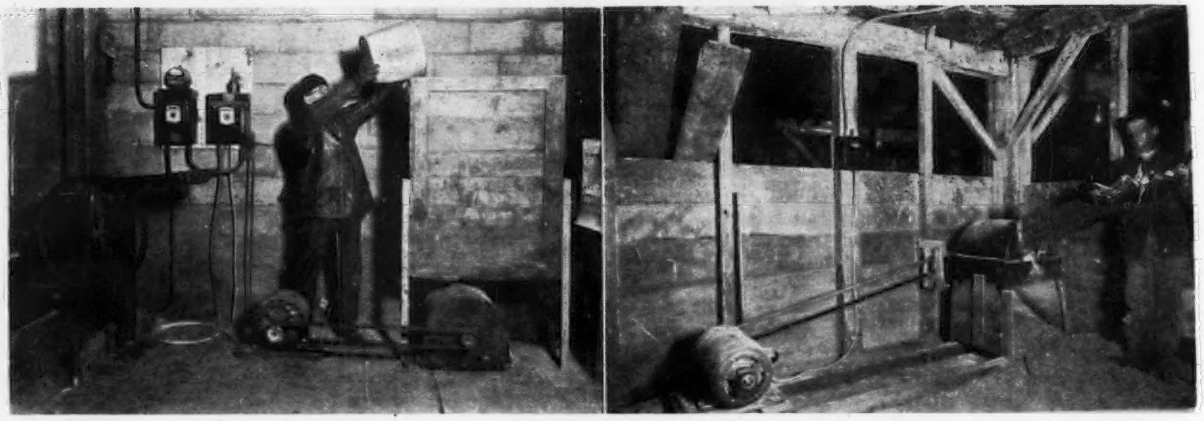
¼-inch screen .....0.766 kw-hr.
⅛-inch screen .....2.61 kw-hr.
1/16-inch screen .....4.40 kw-hr.

Sixty hogs were used in the experiment, divided into six lots of ten hogs each. One lot used as a check received shelled corn and tankage in the ratio of 100 pounds shelled corn to 10 pounds of tankage. The remaining five lots were fed corn, oats and tankage with oats replacing one-fourth of the corn. The results of the feeding trial follow:

	Average gain in 90 days	Average daily gain	Feed cost per 100 lb. grain
Corn and tankage	75 lb.	0.84 lb.	$ 8.72
Corn and tankage, whole oats ...	66 lb.	0.73 lb.	10.31
Corn and tankage, coarsely ground oats, ¼-in. screen	88 lb.	0.98 lb.	8.64
Corn and tankage, medium ground oats, ⅛-in. screen	95 lb.	1.06 lb.	8.42
Corn and tankage, finely ground oats, 1/16-in. screen	91 lb.	1.01 lb.	8.96

More cooperative research of the nature of the Purdue experiments is needed to provide definite information as to costs of grinding feeds, increased feeding values as a result of grinding, and net gains to be expected from the practice of grinding. Some of the variables in the problem are the numerous kinds and grades of livestock, purposes for which they may be fed, market considerations, kinds and grades of feeds which may be fed, degree of fineness, and the several items which contribute to the cost of grinding.

[1]Agricultural engineer, Purdue University Agricultural Experiment Station. Mem. A.S.A.E.



(Left) This 2-hp. motor drives a feed grinder that grinds the grain for eighteen head of dairy cows on the farm of O. C. Hendrix, near Burlington, Ind. The energy consumption is 27 kw-hr. per month. (Right) The cost of grinding feed with this outfit, on the farm of Gus L. Swanson, near Attica, Ind., is only a few cents per hour

The results of this experiment as in that with the dairy cattle show that grinding of certain grains returns a profit above the cost, but that very fine grinding is not warranted by the small extra return.

Other experiments dealing with the value of grinding alfalfa and soybean hay for dairy cattle and of oats for fattening steers are already under way or nearing completion. Additional data are being secured on the depreciation, repairs, etc., of the feed grinders as well as the power cost in order to determine the entire cost of farm grinding. The results of this work coupled with the feeding trials already completed or now underway show the necessity for the coordination of some investigational work carried on by various branches of agriculture with agricultural engineering.

A Simplified Poultry Mash Hopper

By Deane G. Carter[1]

AS A phase of study in the simplification of farm structures the Arkansas Agricultural Experiment Station has developed plans for a poultry mash hopper, as illustrated by the accompanying drawing. There are feeder designs similar in type to this one. The objects of the present study, however, were to develop a feeder requiring an exact simple bill of material, a minimum amount of lumber, lowest possible cost, and an easy, explainable method of construction.

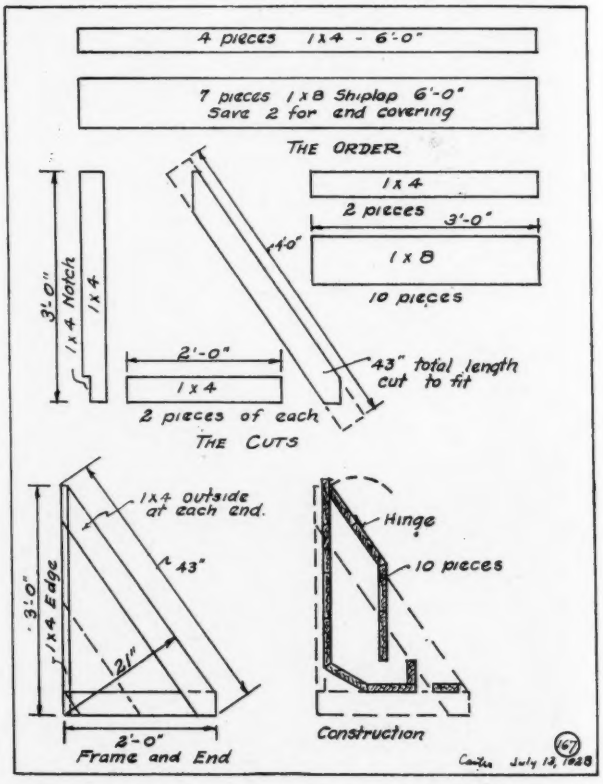
These requirements are vital in the development of a service which is to be of value to 4H club boys and girls, school shop pupils, and those who are not familiar with construction methods.

The feeder is 3 ft. long, and 3 ft. in total height, so designed that all material is cut from two dimensions of 6-ft. commonly available lumber. Therefore, the order may be for four pieces of 1x4-in. boards, and six pieces of 1x8-in. shiplap, all 6 ft. long. This is a total of 32 board feet, which at local prices represents a cash cost of about $1.

All of the material may be "pre-cut" except the diagonal pieces at the ends of the feeder. It is more simple to mark and cut these pieces to fit. However, if more than one feeder were to be built, the lumber might be ready cut from a pattern.

In the construction the 1x4-in. end pieces are fitted to make a pair of triangular frames. The 3-ft. lengthwise pieces are then put in and nailed as illustrated. The covering on the ends is put on diagonally to save material and cutting. Pieces of scrap material are used for cleats under the cover, and a lath is cut and tacked on to form a guard over the trough. One pair of 4-in. strap hinges and a screen door hook are required.

In practice we have used ordinary crating lumber for the framework. The shiplap is the lowest cost matched lumber. The result is a compact, substantial mash hopper.



Drawing showing details of construction of the Arkansas poultry mash hopper designed by D. G. Carter, agricultural engineer

[1]Professor of agricultural engineering, University of Arkansas. Mem. A.S.A.E.

Results of Combine Studies in Pennsylvania[1]

By H. B. Josephson[2]

AFTER studying the combine harvester in Pennsylvania for the past two seasons we can, with a fair degree of assurance, lay down the problems that must be solved before this method of harvesting grain can be accepted as a satisfactory substitute for the binder method in this state.

It is true that a number of standard western machines used in Pennsylvania have met with entire satisfaction from their owners. These combines have operated on specialized grain farms under conditions similar in many ways to those of large western farms, and very different from those encountered on the majority of Pennsylvania farms. At present the number of such farms is relatively small. Perhaps the number will increase when the advantages of the combine method of harvesting become better known. However, if the combine does not spread beyond those specialized farms it will not, for some time at least, play an important part in Pennsylvania agriculture.

The majority of farms in the state growing grain are livestock farms. Wheat and oats are grown in a three or four-year rotation and usually do not constitute more than one-half the crop acreage. On such farms small grains are grown for the straw as well as for the grain, the straw being valued at about $8 per ton. When we consider that the average crop acreage of all Pennsylvania farms is only 42 acres and the acreage of both wheat and oats is only 19 acres per farm, it is apparent that small acreage per farm is one of the limiting factors of the combine method of harvesting grain. The average size farm taken over the entire state probably is not a good working basis, but if we take a typical mixed farming section in Centre County, Pennsylvania, we find that on 100 farms taken at random the average acreage per farm is 23 acres of wheat and 17 acres of oats, or a total of 40 acres of small grain per farm. In considering the future of the combine in Pennsylvania it must be remembered that the majority of farms come within this class.

COST STUDIES

Cost studies were made on the Pennsylvania State College farm in the summer of 1927 with a 9-ft. combine driven with auxiliary engine. These studies were made under typical Pennsylvania conditions. The fields were small, rough and irregular. Table I gives a detailed cost record of harvesting wheat and oats with this machine. It was assumed that the machine would harvest 100 acres per year and last 15 years.

The cost per acre for harvesting by the combine method and leaving the straw in the field was found to be $4.16 per acre for wheat and $4.59 for oats. The yield of wheat was 17 bu. per acre and of oats 45 bu. per acre, bringing the cost per bushel to $0.245 for wheat and $0.102 for oats.

The cost of removing the straw from the field by means of a side-delivery rake and hay loader is given in Table II. This was $2.47 per acre for wheat and $2.54 for oats. Fig. 2 shows the method used in removing the straw. This method involves a great deal of labor. It required more labor to remove the straw than to harvest the grain by the combine method. It required almost as much labor to remove the straw as to haul the sheaf grain to the barn and put it in the mow. Some other method of handling the straw will have to be developed before the livestock farmer who requires all the straw can use the combine method to advantage.

The cost of harvesting wheat and oats under similar conditions with the binder method is given in Table III. The cost per acre was found to be $5.71 for wheat and $6.99 for oats. The cost per bushel was $0.336 for wheat and $0.155 for oats, as against $0.245 for wheat and $0.108 for oats when the combine method was used. The saving due to the use

TABLE I. Cost of Combine Harvesting

Nine-foot combine pulled with general-purpose tractor; straw left on field

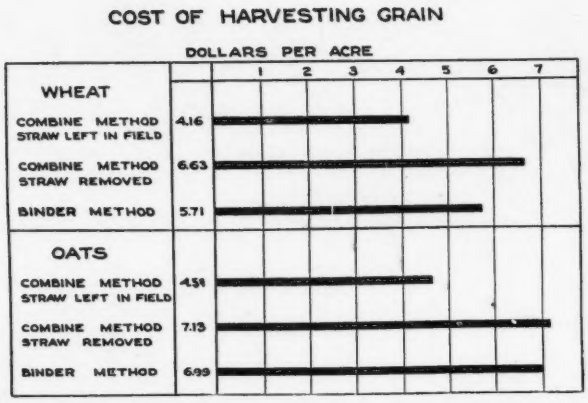
	Wheat	Oats
Yield—bu. per acre	17	45
Labor—man-hours per acre		
Combine operator	0.92	1.15
Tractor operator	0.82	0.97
Hauling grain	1.00	1.15
Total man-hours per acre	2.74	3.27
Horse-hours per acre—hauling grain	2.00	2.30
Tractor hours per acre	0.78	0.93
Kerosene used in tractor per acre (gal.)	1.32	1.30
Gasoline used in combine per acre (gal.)	0.73	1.30
Cost per acre—		
Man labor at 30 cents per hr.	$0.82	$0.98
Horse labor at 20 cents per hr.	.40	.46
Tractor—fixed charges at 50 cents per hr.	.39	.47
Kerosene at 15 cents per gal.	.20	.19
Gasoline at 21 cents per gal.	.15	.27
Oil and grease	.12	.14
Combine harvester—fixed charges*	2.08	2.08
Total cost per acre	$4.16	$4.59
Cost per bushel	.245	.102

*The cost of using the combine is figured on a basis of harvesting 100 acres per year and a useful life of 15 years. The yearly cost of repairs (including labor) is estimated at $27 and housing cost at $20.00. The first cost of the machine was $1630.

[1]Fifth of a series of six articles based on the results of a power and labor research study at the Pennsylvania State College. Released for first publication in AGRICULTURAL ENGINEERING as technical paper No. 458 of the Pennsylvania State College, School of Agriculture and Experiment Station.

[2]Agricultural engineer in charge of farm machinery research, Pennsylvania State College and Agricultural Experiment Station. Mem. A.S.A.E.

Fig. 1. (Left) Wheat was harvested by this 9-ft. combine with 2.7 man-hours per acre as against 8.5 man-hours per acre with the binder method. Fig. 2. (Right) Removing the straw by this method is expensive. It requires more labor than harvesting with the combine



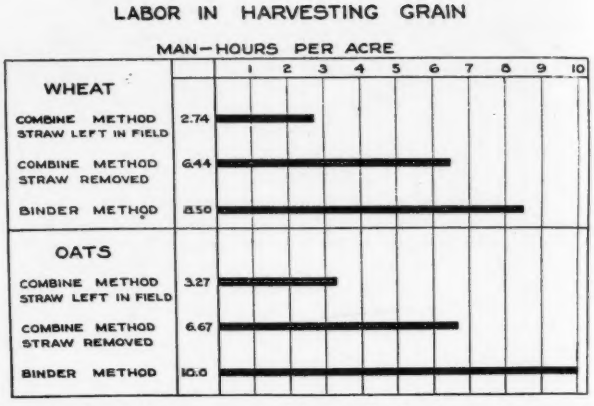


Fig. 3. (Left) The combine method effected a considerable saving in cost when the straw was left in the field. However, when the straw was removed the combine method proved more expensive than the binder method. Fig. 4. (Right) Only about one-third as much labor was required to harvest wheat and oats by the combine method, when the straw was left in the field, as by the binder method. When the straw was removed the combine method still effected a considerable saving of labor

of the combine was then $0.091 per bushel for wheat and 0.047 for oats when the straw was left on the field.

Fig. 3 shows graphically the relation between the cost of the combine method and the binder method of harvesting wheat and oats, both when the straw was left on the field and when it was removed. It will be seen that the combine method effected a considerable saving in cost when the straw was left on the field. However, when the straw was removed it cost more to harvest by the combine method.

LABOR SAVING

The labor requirements of harvesting by the two methods is shown in Fig. 4. When the straw was left on the field it required only 2.74 man-hours per acre for wheat and 3 27 man-hours for oats as against 8.5 man-hours per acre for wheat and 10.0 man-hours for oats by the binder method, a truly phenomenal reduction. When the straw was removed behind the combine the reduction in labor was yet considerable over the binder method.

IMPORTANT COMBINE PROBLEMS

The following conditions and requirements present real problems upon the solution of which depends the future of the combine in Pennsylvania:

1. Small grain acreage per farm
2. Straw saving
3. Grain drying
4. Rolling topography.

Small Grain Acreage. It would seem that 100 acres per year would be the very minimum for profitable operation of a 9-ft. combine. In the majority of cases in Pennsylvania, therefore, the machine would have to be used on two or more farms. This would mean joint ownership or custom work. No combines have as yet been operated on this plan. It remains to be seen how it would work. It certainly would have its disadvantages as delays in harvesting are a serious matter with most farmers. The small farm is undoubtedly an argument for a small machine. The author believes that the smallest machine that can be built with a reasonable threshing capacity for about a seven-foot cut will most nearly meet the requirements. Such a machine may find use on a large number of individual farms and possibly in a greater number of cases could be profitably used on two farms.

Straw Saving. It was found impossible to cut as low with the combine as is ordinarily done with a binder. The stubble left by the combine was from 12 to 24 in. long. Considerable straw was therefore wasted. It is a question whether it would be justifiable to cut tall grain close to the ground and run that volume of grain through the combine for the sole purpose of saving the straw. This would necessitate a much larger thresher with a corresponding increase in power requirements. However, if straw is to be saved by low cutting, the conventional binder platform with adjustable reel would be more suitable than the regular combine header. It seems that under many conditions a convenient reel adjustment would be desirable.

It is not likely that any method of handling the straw loose from the field will meet with much success. Some method of putting the straw in small bales or bundles seems more feasible, if this could be done without too much additional machinery. It has been suggested that a separate operation be made of cutting and gathering the straw when it might at the same time be put into bundles or bales. In actual cost such methods are likely to meet close competition with the old method of binder harvesting.

Grain Drying. Moisture studies indicate that it will not be possible to harvest grain in all seasons with a low enough moisture content for safe storage under the humid climatic conditions existing in this section. This, however, is not as serious a drawback to the use of the combine as might be supposed; a great deal of grain is spoiled in the shock every year on account of wet weather. If a satisfactory method is developed for removing a small amount of excess moisture from grain on the farm, the use of the combine will be greatly enhanced. Considerable work is being done at vari-

TABLE II. Cost of Removing Straw After Harvesting with Combine*

	Wheat	Oats
Labor—man-hours per acre	3.7	3.4
Horse-hours per acre	2.5	3.3
Cost per acre—		
Man labor at 30 cents per hr.	$1.11	$1.02
Horse labor at 20 cents per hr.	.50	.66
Machinery**	.86	.86
Total cost per acre	$2.47	$2.54

*Using side-delivery rake and hay loader.

**Cost of using machinery is figured at one-half the cost of using these machines for hay making.

TABLE III. Cost of Harvesting with Binder Method Threshing done in barn

	Wheat	Oats
Yield—bu. per acre	17	45
Labor—man-hours per acre		
Cutting (2 men)	1.0	1.2
Shocking	1.2	1.5
Hauling to barn and mowing	4.2	4.5
Threshing	2.1	2.8
Total man-hours per acre	8.5	10.0
Horse-hours per acre—hauling	2.7	2.8
Tractor-hours per acre—cutting	.46	.5
Cost per acre—		
Man labor at 30 cents per hr.	$2.55	$3.00
Horse labor at 20 cents per hr.	.54	.56
Tractor at 84 cents per hr.	.39	.41
Binder	.87	.87
Binder twine	.34	.35
Threshing*	1.02	1.80
Total cost per acre	$5.71	$6.99
Cost per bu.	.336	.155

*Machine and operator—wheat, 6 cents per bu.; oats, 4 cents per bu.

ous experiment stations throughout the east in an effort to solve this problem. A ventilated grain bin using only natural circulation of air has given good results at the Pennsylvania Agricultural Experiment Station this year. However, this has not been tried sufficiently to draw final conclusions. The gran-drying problem seems to present fewer difficulties than that of saving the straw.

Topography. Although there are many level farms in Pennsylvania rolling topography is more general. Grades up to 8 per cent are common, and the combine should be capable of operating on hillsides up to 10 or 12 per cent without wasting grain. The grain cleaner is the part of the machine most affected when working on slopes, and a side slope hinders the working of the sieve more than traveling up or down hill. In these tests considerable losses were observed when operating on hillsides in heavy grain. The grades commonly encountered would hardly warrant the use of a hillside machine with its added cost. However, a leveling device for the grain cleaner which would function on hillsides would be a decided advantage.

CONCLUSIONS

The combine method of harvesting grain in this section is yet in the experimental stage. It has been pointed out that on the average farm, where wheat and oats are grown for straw as well as grain, a saving in cost is not to be expected with the present methods of disposing of the straw. With improvements this condition may be changed. The advantage of the combine under these conditions does not seem to be so much in saving actual cost as in reducing the total labor required in harvesting the crop.

Broad Irrigation with Sewage[1]

By G. E. P. Smith[2]

IN DECEMBER, 1900, I visited California for the first time. When told that the city of Pasadena was utilizing the city sewage for irrigation, I was shocked, scandalized. I went to the city farm and spent a half day inspecting it with the manager. I saw a walnut grove in full bearing, a young citrus grove, and other crops, all spick and span, with no semblance of a nuisance anywhere, and I came away a convert to the idea of sewage disposal by irrigation in those sections of the country where proper criteria are met. I believe that today the sewage of parts of Los Angeles, instead of being cast into the sea to pollute the beaches, should be reclaimed and used to supplement the admittedly inadequate irrigation water supplies of Los Angeles and Orange Counties.

Although sewage disposal by direct use for irrigation finds little favor in America, except in the semi-arid Southwest it is very common in Europe. This type of disposal is especially well exemplified at Berlin, Germany. Last summer I had the opportunity to investigate the method as practiced by the efficient and thorough sanitarians of that country.

Berlin, in common with other great industrial centers, has had a remarkable growth during the past fifty years. Situated chiefly on low lands, the problems of sewage are unusually difficult. Although the Spree is adequate for barge traffic, the volume of flow is too small to permit the disposal of sewage by dilution.

The collecting system is composed of seventy-five districts with separate networks of street sewers. In each of the seventy-five districts, the street sewers drain by gravity to a pumping plant, where the sewage after passing coarse screens, parallel bars set so as to give one-inch openings, is forced into cast iron or wrought iron mains from 24 to 48 in. in diameter, under pressure heads ranging from 65 to 165 ft. These mains conduct the sewage to the great estates or farms owned by the city, which are 10 to 15 mi. from the pumping plants. The yearly pumpage is 46 billion gal. equal to 140,000 acre-feet.

The pressure pipes, in many cases, are connected by crossovers provided with gates, so that the discharge from one plant may be distributed to several of the large farms or the discharge from several plants may be concentrated on one farm. The pressure pipes total 330 mi. in length and there are also on the farms, 156 mi. of distributing pipe lines from 10 to 20 in. in diameter.

Approximately 30,000 acres are irrigated with the sewage. The soil, for the most part, is fine to medium sandy loam, and the topography is slightly rolling, at least this is true of the great farm at Buch, the one visited by the writer. At Breslau, where the same system is used, the soil is much heavier, and the penetration is notably slow.

The principal crops raised are rye, oats, timothy, Italian and English rye grasses, and cabbage, potatoes, carrots, beets and other vegetables. Land for rye is irrigated but once between plowing and planting, vegetables four to six times in a year, and meadows may be irrigated as many as ten times and may be cut six or seven times. Pastures are irrigated once in summer and once in winter. The milk yield is estimated at 1000 gal. per acre annually, four times as great as it would be without irrigation. Alfalfa does not do so well with sewage water. Potatoes are not irrigated during their growth, and also it should be said that the sewage is not allowed to come in contact with any vegetables.

Various methods of application are used, depending on the slope of the land and the crop. Grass lands are laid out in basins or are irrigated by flooding from field ditches. Vegetables are irrigated in deep furrows. The applications are rather heavy, but ample time is allowed for thorough oxidation before the next irrigation.

In the past twenty years many basins have been prepared for rapid soil filtration. These basins are about 165 ft. square and are underlain at a depth of 4 ft. by clay tile pipe for drainage. Sewage is applied from 12 to 14 in. deep, from four to ten times a year, though more frequent applications would be possible. The underdrain pipes discharge into artificial drainage ditches, from which the water is led to a second irrigation on grass lands, to artificial fish ponds, or, at some seasons of the year, to creeks and through them to the river. The cost of the clearing basins is about $100 per acre for preparation, and while they are not considered necessary and are used for a minor part of the total volume, they will help to solve the problem of the increasing volume of sewage.

There are a great number of drainage ditches and small natural water courses, and inasmuch as the evaporation rate in the latitude and climate of Berlin is very low, it is inevitable that ultimately most of the sewage water is returned to the river. The effluent is uniformly of good quality, equal to or better than that from artificial, biological methods.

The fish ponds, which were built originally at the order of the city health board, are stocked with carp. It was found that the fish thrive in the once-filtered water with its luxuriant growth of algae, and they have become an important source of income, stated to be $40 per acre.

Sewage disposal by use for irrigation has encountered strong opposition among sanitary engineers in America in recent years, but it undoubtedly has a place in the arid Southwest, where climate and soil conditions are favorable. At Tucson, Arizona, the city sewage has always been disposed of by irrigation with apparent success and with a yearly net profit to the city. No difficulty has been encountered except twice, when the increase in acreage had fallen far behind the growth in population. Greater success could have been attained with a higher type of management. In California there are several score of disposal systems in which the sewage is used for irrigation, either raw or with more or less indifferent pretreatment, some of which accom-

[1]Abstract of a paper presented at the first annual meeting of the Arizona Public Health Association and published in the July, 1928, bulletin of the Arizona State Board of Health.

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plishes more harm than good. Where local conditions permit this type of disposal, the effort should be to spread the sewage quickly and get it into the ground and let the millions upon millions of soil bacteria oxidize the organic matter without the intermediate process of putrefaction. The two criteria for success, in case this type of disposal is adopted, in addition to light soil and mild climate, are first, an adequate area in proportion to the volume of sewage, and second, an intelligent, scientific manager, who should be not only a good executive, but thoroughly grounded in the principles of soil bacteriology, irrigation, and agricultural practices.

A New Type of Concrete Building Block

"A TYPE of concrete block adapted to the economical construction of farm buildings" is the characterization of the L-block given by its designers, J. B. Davidson[1] and Henry Giese[2].

Shaped as its name implies, like the letter L, this block can be cast in gang molds at a low labor cost and laid up into walls which have most of the advantages of other forms of concrete construction, but which are far more economical of material and labor. As stated by the designers, with normal costs for constitutent materials, plastic concrete is an economical building material. Economical construction with it depends upon the efficiency with which the material is applied and the labor required to apply it.

An attempt to make silo blocks in a gang mold originally suggested the L-shaped block. In 1919 the first L-blocks were cast in a collapsible wooden box with thin sheet metal partitions held in place by cleats. Experience led to the use of heavier partitions and finally to the development, by Mr. Giese, of the all-metal molds in use at present.

In 1923 the block was made the basis of a project of the Iowa Agricultural Experiment Station. An experimental building, the walls of which were entirely of L-block, was built. It is a one-story shed, 24 feet wide by 84 feet long. Several methods of using the blocks were tried in this structure. The experience of building this shed and subsequent observation of it has given much practical information on the casting of the block and building with them. A number of persons in Iowa and neighboring states have since successfully used L-block in various types of farm buildings.

As previously stated the L-block makes efficient use of material. A minimum amount is required to secure enclosures and stability. It can be cast without a great amount of tamping and can be handled easily and quickly, on account of its lightness, and can be laid up rapidly in a wall.

Used alone or in combination with insulating materials, L-block can be made into insulating walls to minimize the passage of either moisture or heat or both.

As to disadvantages, its lightness renders the block unsatisfactory for heavy construction, except as a backing for brick or other material. Few building codes permit its use. Building codes, however, are rarely in force in rural territories. Considerable care must be taken in laying the block to secure good joints.

A rich, dense grade of concrete must be used in L-blocks to make up in strength what is lacking in bulk and to make the blocks reasonably moisture-proof. A mixture of one part cement, one-tenth part lime, two parts sand and three parts gravel or crushed stone will be found satisfactory. An L-block wall made of this quality concrete will have a crushing strength of between 30 and 45 tons.

Twenty-five forms make a convenient gang. All-metal forms are now commercially available. Filling a gang once each day a farmer can soon accumulate enough blocks for a good sized building. In warm weather it may be found practicable to fill the forms twice a day, or in cold weather once in two days.

The amount of labor required depends largely upon the convenience of the arrangement for casting and subsequent curing. A concrete mixer into which the materials may be scooped and from which the mixed concrete may be wheeled directly to the forms, is a big help. At Iowa State College, using 107 forms and including all operations, the labor required was 1.55 man-minutes per block.

Cleaning and oiling the forms is an essential step in the operation. A wire brush will do the cleaning and discarded crankcase oil is satisfactory for oiling.

For curing, the blocks, after removal from the forms, should be piled up away from direct sunlight and kept moist for at least ten days. After thirty days they will be cured sufficiently to be readily handled. They may be used sooner but must be handled carefully and kept moist for the duration of the curing period.

Local conditions will materially affect the cost of making L-block. Those of the size shown in the drawing weigh from 18 to 20 pounds and 190 of them can be made from a cubic yard of concrete. For a 1:1/10:2:3 mixture the designers figured the cost of materials as follows:

Cement, 1.8 bbl	$5.04
Lime, 0.5 cu. ft.	0.25
Sand, 0.5 yd.	0.25
Gravel, 0.76 yd.	0.85
Cost of concrete per cu. yd.	$6.39
Cost per block	$0.034

The total cost per block was summarized as:

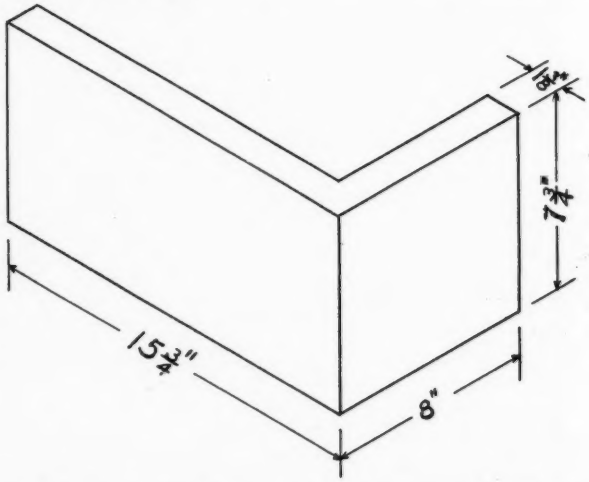
Materials	$0.034
Equipment and overhead	0.020
Labor	0.015
Total	$0.069

This cost might be reduced, especially the labor item, under favorable conditions.

The masons who helped build the experimental building found that the blocks laid up easily and that the narrow mortar were not troublesome. In the double wall they laid up at the same rate as 5x8x12 in. tile. In the single wall they laid up twice as fast.

Special attention should be given to the foundation and roof construction of an L-block building. Due to the lightness of the wall it will not withstand strains caused by settling foundations or roof loads other than vertical.

EDITOR'S NOTE: More detailed information on how to make and use L-blocks is available in Iowa Agricultural Experiment Station Bulletin No. 249, entitled "The L-Block." Address the station at Ames, Iowa.



The L-block, showing dimensions which have proven most satisfactory under ordinary conditions

[1]Professor of agricultural engineering, Iowa State College. Charter A.S.A.E.

[2]Assistant agricultural engineer, Iowa Agricultural Experiment Station. Mem. A.S.A.E.

Committee Makes Recommendations for Corn Borer Control Activities[1]

THE European corn borer, which was first discovered in New England in the summer of 1917, has continued its natural spread until at the present time (September, 1928) the insect occurs throughout more than 230,000 square miles of territory in North America, including the whole or parts of the northeastern states; New York, Pennsylvania, West Virginia, Ohio, Michigan and Indiana; and parts of the provinces of Ontario and Quebec in Canada. Vigorous measures have been taken to prevent long-distance spread by artificial means. This effort has been successful. The only known spread of any importance in the United States, therefore, has been by the natural flight of the corn-borer moths or by water-drift of infested material. This spread has been at an average rate of from 20 to 30 miles per year. From any information now available there appears to be no practicable means of preventing this natural spread.

The results of the extensive studies of the borer in this country and in Central Europe furnish convincing evidence that the insect is of tremendous potentiality and ranks as one of the most alarming crop pests ever introduced. The situation, presenting, as it does, the possibility of a national calamity, calls for the continued cooperation of the farmer, the scientist, the educator, and all state and federal administrative officials.

The intensity of infestation by the corn borer in the western area has increased steadily since its discovery there in 1920. Before clean-up practices were applied in Kent and Essex Counties, Ontario, severe commercial damage was suffered, and this resulted in a large reduction of corn acreage. Since clean-up practices have been applied in that district there has been a decrease in the intensity of infestation and an increase in acreage. This is a hopeful indication of the effectiveness of control measures and the possibility of continued corn production under conditions thought to be most favorable to the borer.

The cooperating committee of entomologists, agronomists, agricultural engineers, and agricultural economists wishes to endorse most heartily all efforts to control the corn borer, and to commend all persons engaged in the research, regulatory, and educational activities.

The committee recognizes the necessity for the fullest development of the research, educational, and quarantine programs of the state and federal governments and earnestly recommends the appropriation of the funds necessary to maintain and expand these activities. However, the committee does not favor a large federal appropriation for a compulsory clean-up campaign for the following reasons: (1) The break in the continuity of the clean-up program in 1928 due to the failure of the appropriation for this purpose; (2) the impossibility of securing an appropriation in time for an effective clean-up to protect the crop of 1929; (3) the impracticability of enforcing effective clean-up under present state laws.

After careful and complete investigation of the corn borer regulatory, research, and educational activities, the committee suggests and recommends:

1. That the state and provincial agricultural experiment stations, the state departments of agriculture, and all other agencies interested in the welfare of American agriculture, give their support and encouragement to the federal governments of the United States and Canada in their policies on quarantine activities. Scouting should be continued in the areas contiguous to known infested areas and extended to the large corn-producing states where areas seem particularly exposed to infestation. Ample federal funds should be available for a thorough clean-up of isolated infestations.

(2) That major efforts in corn borer research, control, and educational activities be directed toward making possible the maintenance of our present corn acreage, in view of the economic importance of corn and the present advantages which this crop holds over any alternative crop as a revenue producer in the corn belt, and the certainty that farm incomes will be greatly reduced unless this is accomplished.

(3) That the corn-breeding program to produce strains that may be resistant or tolerant to the corn borer, or which may escape attack, should be continued.

(4) That soil and cultural practices that may avoid reduction in yield and quality of corn by the corn borer, such as time, rate, and method of planting, soil fertility treatments, and retardation studies, should be investigated further.

(5) That studies should be continued on the physiology and morphology of the corn borer and its hosts, especially the corn plant, in relation to infestation, establishment, and damage and to the yield of corn.

(6) That there be continued on many fields distributed over the area of heavy infestation, the study of the relation of corn borer infestation to time of planting, variety, soil type, height at the peak of moth flight, earliness of maturity and yield of corn.

(7) That the study of the ecology of the corn plant be extended to the entire corn belt and that similar studies of the corn borer be extended as the spread of the insect permits.

(8) That experiments on the long-time effect of various clean-up practices of soil productivity be continued.

(9) That attention be given to studies of the possible substitution of other profitable crops for part of the corn acreage in the rotation in those sections where the corn borer promises to become a destructive pest. Such studies should include specifically the present and probably future market outlook for these substitute crops.

(10) That studies should be made on reduction in yield or increased cost of crops other than corn, through changed methods as a result of the advent of the corn borer.

(11) That efforts to determine the reduction in yield and quality of corn resulting from different densities of borer population, should be continued and enlarged to include determinations of such damage at different degrees of soil productivity. Such information is essential to reliable recommendations as to varieties, cultural practices, and possible substitute crops for corn, as well as to determine the clean-up practices that will be profitable.

(12) That detailed cost account work should be done, both within and outside of the infested areas, for the purpose of determining the costs of different farm operations, to serve as a basis for recommending changes in practices if they should become necessary.

(13) That the important project now under way to introduce and establish parasites of the corn borer from foreign countries, be continued and enlarged. It also is recommended that all such intitial introductions of parasites, predators, entomophthorous fungi and bacterial diseases from foreign countries be entirely under the direction and supervision of the U. S. Department of Agriculture or the Department of Agriculture for Canada.

(14) That continued studies should be made of the habits, life history, and environmental influences affecting the spread of the corn borer and intensity of infestations, also upon the limitations of corn as to its seasonal, varietal and cultural practices. Such information is essential to combatting the corn borer and will assist the entomologists, agronomists and engineers in the development of controls.

(15) That the experiments and demonstrations to determine the value of plowing under corn residues as a means of destroying the corn borer should be continued. These studies should include a determination of the comparative value of fall and spring plowing in different types of soil,

[1]Report of the joint Committee on the European Corn Borer, appointed by the American Association of Economic Entomologists, the American Society of Agronomy, the American Society of Agricultural Engineers, and the American Farm Economic Association, presented at the 4th Annual Corn Borer Conference called by the International Corn Borer Organization, at Toledo, September, 1928.

with different widths and types of bottoms, on different dates, and at various depths.

(16) That the experiments in the large screened areas should be continued to determine the relative degrees of infestation and damage to be expected: (a) Where no effort at clean-up is made and (b) where the most practical clean-up methods are employed.

(17) That investigations upon insecticides, repellants and attrahents be continued.

(18) That in one-generation areas the study of weeds and plants other than corn be continued to determine what part these may play in the future as breeding hosts of the borer, especially in districts where, owing to the severity of the infestation, corn growing may be reduced temporarily.

(19) That in view of the interdependence and machinery requirements and design, intensive development work should be continued. The experimental and research programs should be correlated with control methods and large-scale field procedure.

(20) That the control of the corn borer by mechanical means is of demonstrated importance and undoubtedly will continue to be so as long as the pest remains a menace to the corn crop of the country, and therefore comprehensive and vigorous research programs relating to mechanical operations of crop production and commercial utilization should be continued by state and federal agencies.

(21) That we endorse the machinery development program which is being conducted by state and federal agencies along crop production and utilization lines. Since no one method or machine is adapted to all conditions, it is recommended that more complete information be made available in regard to cost and effectiveness of using rakes, burners and other stalks and remnant disposal machinery and other devices to supplant hand labor.

(22) That studies be made to determine the effects on farm incomes of different methods of harvesting and utilizing corn stalks, both commercially and on the farm.

(23) That radical changes in agricultural practices should be recommended only if justified by the results of economic surveys including farm cost records.

(24) That the state and federal agricultural extension agencies take every opportunity by demonstrations, exhibits, and lectures to acquaint their constituencies with the gravity of the corn-borer problem, the nature of the insect and its work, and the methods of meeting the situation. The need of the cooperation of every grower in the regions adjacent to the infested area as well as within recognized corn-borer territory should be emphasized.

(25) That federal and state administrative authorities be urged to make available at frequent intervals up-to-date information regarding the general situation and the progress of investigations in the United States, Canada, and abroad, through the medium of bulletins, circulars and leaflets. Also that, where advisable, mimeographed statements of progress be issued at frequent intervals to technical workers.

(26) That the committee act as a clearing house in advancing corn-borer control measures by obtaining opinions from the entomologists, agronomists, agricultural engineers, agricultural economists and others, as to the lines of research and other methods which should be pursued, with special reference to needed investigations not now under way and which may have a practical application to the problems.

(27) That the fullest program of research be conducted along all lines offering promise of assistance and the fullest financial support for such research programs be provided, research being recognized as the basis of all progress in methods of control of the corn borer.

(28) It is recommended that copies of all written reports or recommendations of the committee be made available to the Secretary of the U. S. Department of Agriculture and the Minister of Agriculture for Canada.

Respectfully submitted,
JOINT COMMITTEE ON THE EUROPEAN CORN BORER

For the Entomologists—
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L. Caesar
D. J. Caffrey
G. J. Drake
J. J. Davis

For the Agronomists—
L. E. Call
W. L. Burlison
J. F. Cox
R. M. Salter
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For the Agricultural Engineers—
C. O. Reed
R. D. Barden
R. B. Gray
A. L. Young

For the Agricultural Economists—
C. R. Arnold
H. C. M. Case
O. G. Lloyd
C. L. Holmes
H. R. Tolley

NOTE: Due to the forced absence of the chairman (C. O. Reed) and A. L. Young, of the Committee on Corn Borer Control of the American Society of Agricultural Engineers, R. D. Barden, acting chairman, and R. B. Gray of the present committee, and H. H. Musselman and R. H. Wileman of last year's committee, represented the Society in the joint sessions of the four committees at the recent corn borer Conference. To these men belongs credit for able representation—C. O. Reed

Four Years of Rural Electrification at Red Wing

IN AN article with the above title in the "N.E.L.A. Bulletin" for August, Charles F. Stuart, chairman, rural electric service committee, National Electric Light Association, states that the question of whether or not there is, on the farm, an acceptable load for electric light and power companies has been answered emphatically in the affirmative.

A report covering the four years of project work (1924-28) in connection with the University of Minnesota experimental line at Red Wing, gives convincing figures on the financial results of the experiment. Increase in net income to the farmers, over 1924, was 42.5 per cent in 1925; 54.6 per cent in 1926; and 81 per cent in 1927. This increase follows the increasing use of electricity on these farms. Their operating expenses were decreased for these years except in 1927, when an increase in taxes raised the operating expenses one per cent over the year 1924.

These results were obtained under rates and conditions which proved profitable to the power company. Mr. Stuart summarizes the results obtained for both the farmer and the utility as follows:

"It would seem then that four years' liberal and intelligent use of electricity on these Red Wing farms has produced the following four general results:

"1. It has paid its own way, as represented by the energy bill.

"2. It has paid overhead charges on strictly electrical equipment.

"3. It has paid overhead charges on much other equipment necessary to bring the farm standard of living up to or higher than that of the city resident.

"4. Over and above all these, it has netted these farmers a tidy little profit besides.

"Just as the farmer has wanted to know whether electricity would mean just another item of expense to him so has the power company wanted to know whether there is a load available on the farm. It would seem that there most certainly is. These five farmers during 1927 used an average of 243 kilowatt-hours per month per farm and paid an average bill of $14.77 per month per farm. This is current at about 6 cents per kilowatt-hour. On a basis of three customers to a mile it represents an annual gross revenue of nearly $540 a year."

It is not claimed that electricity has turned these farms into profitable business institutions, as there are a large number of other factors which influence the net earnings of any farm. The farms on the Red Wing line are not unusual in any way and rank close to, possibly a little below, the average for Minnesota.

Mechanical Power in Agriculture[1]

By E. A. Stewart[2]

THE use of mechanical power in agriculture is a modern idea. It is so modern, in fact, that still more than two-thirds of the world's total food supply is secured by man power only, and less than 5 per cent is produced by means which employ mechanical power. It is a striking fact that the world's oldest industry, civilization's most fundamental occupation, should be the least developed of any industry from the standpoint of mechanical power. However, this can be readily explained. The production units are widely scattered; the workers have inherited habits of work through scores of generations; and until the present century agriculture has never had engineering principles and practices applied to its production efforts.

The present generation little realizes that primitive agriculture, with its crooked stick for a plow and a broken branch for a harrow, is only a few generations back of us in this marvelous machine-made country and that primitive agricultural conditions still exist in large areas of the world. Countless millions of the world's population must still produce their food by hand labor.

It has been natural of course to supplant and to supplement man power with animal power from the earliest days of the domesticated animal. Beasts of burden have been used by nearly every human race for transportation and for tillage purposes. Even as early as 3000 B.C., animals were used in Mesopotamia and Egypt for even other purposes than the two mentioned. Pumping water for irrigation and treading out grain on the threshing floor were two early uses of animal power.

Progress in agriculture has been slow, and civilization cannot do more than keep pace with its agriculture. Centuries were required for the crooked-stick plow to change to a shaped wooden plow, and then later to the wooden plow shod with iron. Iron-shod plows were in use in Israel as early as 1100 B.C. Thus, 2000 years intervened from the crooked stick to an iron-shod plow. Even with this development, and only inadequately applied animal power to operate such plows, the hands of civilization were still tied to the task of food production.

One of the greatest marvels of past history is how the Greeks and Romans constructed their wonderful pieces of art and architecture in the early centuries of the Christian era and how the peoples of western Europe constructed their wonderful cathedrals and other structures at a time when grain was cut with a sickle and threshed with the flail. Their conservation of time and food was a wonderful accomplishment compared to our waste of labor and food products, but their lives of drudgery from dawn to dark and their periods of starvation and pestilence furnish a sordid comparison to our present conditions, with many hours of play and recreation, shorter hours of work, and plentiful food supplies. With the necessity for 90 per cent of the population to engage in the production of food and shelter, the medieval peoples could never have left such monuments of art to their civilization by working on union hours. These monuments are really monuments to their lives of drudgery, self-denial, and food conservation.

The Plow Developed. It required more than another 2000 years to change the shaped wooden plow shod with iron into a plow with a curved moldboard, and into a plow that really turned over the dirt instead of merely stirring the soil. About 1700 A.D., the Dutch people perfected a moldboard plow, and they exported it to England in 1730. Developments then began to come rapidly. Within another half-century the cast-iron share made its appearance, and by 1803 the first chilled plows were put on the market. In 1833 John Lane and in 1837 John Deere made the two first steel plows. It was not until about 1850, or less than 80 years ago, that steel plows were put on the market.

The development in plows typifies agricultural development. The plow and the spiked-tooth harrow were our only agricultural implements previous to 1800, the year of my grandfather's birth. Crude types of grain drills, mowing machines, reapers, corn planters, dump rakes, corn shellers, and threshing machines were developed between 1800 and 1850 with only a few being in use when my father was born in 1841.

The year 1850 marks the beginning of modern agricultural machinery. During the next three decades the self-binder using twine, the modern mower, the cylinder grain thresher, the hoe-type grain drills, cultivators, and other tools were developed, and many were in use at the time of my birth in 1885. Animal power was still used almost entirely. A few windmills and steam engines, almost negligible in number, were in use. The large variety of agricultural tools now in use, with specialized equipment for each kind of crop and for use with mechanical power, such as corn planters, potato diggers, corn harvesters, gang plows, hay loaders, combine harvesters, etc., are a development of the present generation; and modern power farming, with gas tractors, trucks, electricity, etc., is now only a baby in swaddling clothes, an infant of fifteen years in the lap of old Mother Agriculture, now thousands of years of age.

During the infantile and juvenile days of machine farming, up to 1875, the new member of the agricultural family had a precarious existence. Cyrus McCormick was hooted and jeered by the crowd of curious onlookers when he demonstrated his reaper; reapers and threshing machines were burned by laborers who were afraid of losing their jobs to the new machine-farming baby. City dwellers, even though they found food scarce and had bread riots and had to import foodstuffs, could not see the importance and the value to civilization of machine farming. Financial houses did not encourage or assist the manufacture of farm machinery, nor did they assist farmers in securing such machinery.

After many years of struggle, the whole civilized world awoke to the fact that the release of workers from the production of foods and raw materials, by the application of machinery, was making it possible for such workers to produce those extras which make the workingman's house a home and make life worth living. The automobile, the fine modern homes, the radio, our transportation methods, parks, museums, etc., have been builded by the labor that machinery has released from the production of food and clothing.

[1]Contributed by the American Society of Agricultural Engineers for presentation at the summer meeting of the American Society of Mechanical Engineers, at St. Paul, Minn., August, 1928.

[2]Formerly associate professor of agricultural engineering, University of Minnesota. Mem. A.S.A.E.

A line shaft inside the pump house drives this grindstone (photo courtesy of Hydro-Electric Power Commission of Ontario)

Even with such machinery as was available in 1850, approximately one out of five people in the United States was engaged in agriculture, while by 1920 not even one out of ten was so engaged, and yet this small number of farm workers produced a very large exportable surplus of foodstuffs.

Machine farming developments from 1850 to 1920 have released approximately 27,000,000 workers from agriculture. Picture the undeveloped state of our cities, industries, transportation, and above all the entire absence of our modern, sanitary and labor-freeing homes if we were still required to produce our agricultural crops as we did one hundred years ago. It takes but little imagination to picture our now beautiful country with its marvelous beautiful cities, as a peasant country ground down under long hours of toil, poorly educated people, faced periodically with famine and pestilence, with simple labor-killing homes for our families to live in if farming were now carried on as it was in 1830.

Power Farming in Its Infancy. History repeats itself. The baby, "power farming," is now being laughed at by many people, and they see it in the same light as they saw the beginnings of machine farming. Conscientious objectors in all walks of life say that "it can't be done." Many people have been and are still opposed to the use of mechanical power to replace animal power in agriculture. Financial interests have done but little to encourage the farmer in using power. "Power farming" is still so much of an infant that great masses of people, including farmers and even agricultural leaders, have not grasped the importance of this new member of the farming family. What machine farming has done for this country in the last century will be more than duplicated by power farming during the twentieth century.

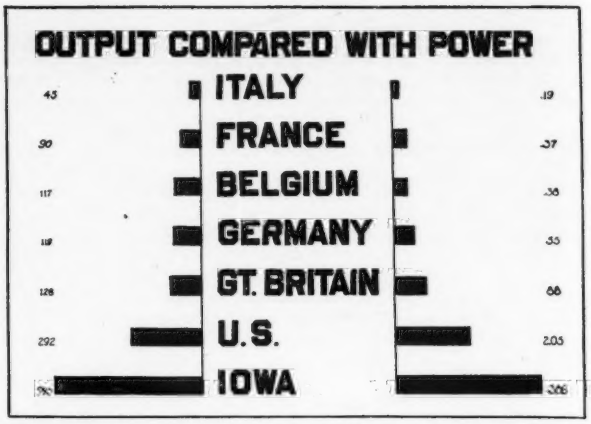
While our population in 1950 may be six times as great as in 1850, yet it is conceivable and probable that the decrease in number of farm workers which started to take place in 1910 will continue and by 1950 no more farm workers will be required to supply food for a population of 150,000,000 than were required in 1850 for a population of 25,000,000. What does it mean to a country to have millions of its workers freed from agricultural pursuits? It means better homes, higher standards of living, lessened hours of labor, better health, and more happiness.

What are some of the things that have already been accomplished by the application of power to farming that lead us to predict what power farming can do? One very interesting result is shown by the accompanying chart. It reveals the very close correlation between volume of production per worker and the equivalent power per worker. A small amount of power per worker as is available in countries like Italy and France gives small returns per worker. Data for our own states show a striking similarity to these data for different countries. Nebraska farmers, with nearly six times the power available per farm worker as is available in Alabama, has an output per worker over eight times as much.

The total power requirements of agriculture in the United States are staggering. In 1924 the estimated primary horsepower on farms was 47,420,000 hp., out of which animal power was less than 20,000,000 hp., while in 1900 animal power constituted more than 80 per cent of the total farm power. In a brief period of 24 years mechanical power on farms has increased nearly eightfold and is now over 50 per cent greater than the animal power. Contrast the total horsepower just stated with that given in the last United States census as 29,504,792 hp. for all manufacuring industries.

This is the status of our baby, "power farming," now barely 15 years of age. What a giant he is likely to be by 1950!

Power intelligently applied to farming practices offers a tremendous opportunity for decreasing labor costs and the total costs of production of farm products. The use of a grain elevator, a hopper-type feed grinder driven by an electric motor, and properly arranged feed bins, enabled one farmer to change a 6-hour job into a 14-minute job. In another case, a farmer by using a milking machine reduced his total daily milking time from 10 hours to 6 hours and 10 minutes. Such applications as these on a widespread scale can revolutionize agriculture in a few years. The average



This chart shows the close correlation between output per worker and power used per worker in agriculture. Figures at the left show relative production per farm worker (world's average is 100), while on the right is shown the amount of horsepower used per farm worker

cost per horsepower-hour of all power used in the United States in 1924 was 19 cents. What other industry could survive with such high power costs?

Since it has been shown that electric power can be secured on farms where used in large quantities at 4 cents per horsepower-hour and even below that, electric power will assist the farmer materially in reducing his power costs. Electricity for agriculture is the infant member of the "power farming" group and is just getting started. The number of farms having "high-line" electric service have approximately doubled since the first experimental work in the world on rural electrification was started at Red Wing, Minn., in 1923. Over 300,000 farms in the United States had electric high-line service at the beginning of 1928. This number of electrified farms will probably more than double again in the next four years.

Large Machine Units Rapidly Coming. The use of large farm machine units, driven by mechanical power, has been increasing very rapidly during the past two or three years. A recent letter from the Department of Commerce states: "The large increases in the output of combines (harvester-threshers) and tractors in 1927 over previous years are indications of the trend of agriculture toward the abandonment of antiquated farm machinery and the adoption of more modern, labor-saving devices. The number of combines manufactured increased from 5131 in 1925 to 11,760 in 1926 and to 18,307 in 1927, and the output of tractors increased from 167,553 in 1925 to 181,995 in 1926 and to 200,504 in 1927."

If the present total crops of the United States could be produced under conditions where the average man-hours per unit of production were even twice those of efficient production with mechanical power, less than one-half of our agricultural workers would be required in agriculture. In some states as much as 42 hours yearly are required per acre of grain raised, while with power farming and combines this can be reduced to less than 5 hours yearly. Corn in some states requires over 60 man-hours yearly per acre, while power-farming methods can reduce this to less than 5 hours yearly per acre. Someone has made a summary of the labor involved in corn production. With one-man power, it requires about 300 hours of man labor per acre of corn; whereas with a one-horse method, it requires about 100 hours of man labor; with two horses, 40 hours; with 4 horses, 15 hours; and with 5 horses only about 9 hours. With the latest type power-driven equipment, a heavy corn crop, far above the average yield, was produced at Iowa State College with less than 3 hours of man labor per acre.

When the average number of hours per acre of corn raised in a state like Iowa, with all of its modern machinery, is more than five times the average on some farms where power-farming methods are used intelligently, it points to the fact that farming conducted under wise direction and with the use of mechanical power can reduce the cost of production to such a point that farming can be made a very

Electricity turning a wringer

lucrative business. Thos. D. Campbell, the wheat king of America, stated recently that he did not know of a single industry where a young man with proper engineering training could make bigger returns than by applying engineering to agriculture on a large scale properly financed. Mr. Campbell, by applying engineering to wheat farming, produces wheat at about one-third of the average cost of production in the wheat belt.

Power in agriculture has many distinctive features. Its use is seasonal, much more so than for city industries. The load factor is very low. Data for 1924 show that only 16,000,000,000 hp-hr. were developed by 47,420,000 hp., giving a load factor of less than 4 per cent. Even if we were to consider just the working day of 8 hours, we have a load factor for working hours of only 12 per cent.

Farmers have not realized what fixed charges and overhead charges are. When agriculture is properly managed from an engineering standpoint, this load factor can be doubled and trebled and fixed charges for power reduced accordingly. Power and labor costs are the most important factors in the cost of agricultural products. Power and labor costs for the average farm amount to about 60 per cent of the cost of production, other fixed costs on land, etc., amount to about 20 per cent, and other operating costs, such as seeds, fertilizer, etc., to about 20 per cent. In some crops, power and labor costs amount to as much as 90 per cent of the cost of production. Does it not seem logical to attack the farm-relief problem at the point where there is the greatest opportunity for effecting a change?

Cutting Costs. If power and labor costs can be reduced by 25 per cent, we shall not need to worry about helping agriculture with a revised tariff or a McNary-Haugen bill. These costs have been reduced more than 75 per cent on many farms. By the use of power we can reduce the man-hours in agriculture so that it will not take 2¼ hours of a farmer's time to produce the same wealth as his city brother produces in 1 hour.

With this utopia of power farming that I have painted for you in mind, you may expect to see agriculture lifted from its slough of despond and stabilized and to see our farm business advancing with strides comparable to the past performance of the automobile industry. This, however, we cannot predict. Applying power to farming is a difficult task. A man to do it must be a farmer, in every sense of the word, a business executive, and an engineer. Farms with capital investments in many cases in excess of $50,000 are going to be necessary for proper success. The Red Wing farms on the experimental electric line have an average investment in excess of $30,000, and these are not average farms of the future.

What percentage of our farmers do you think have developed sufficient business and financial ability so that you would trust them to run a $50,000 engineering and scientific enterprise for you? Is this condition, however, any different than in other infant industries? How many power-company executives did we have in this country capable of handling a $1,000,000 enterprise in 1890? How many do we have today? Where did we get them?

In the same way, men in agriculture must be developed to manage this new type of farming which requires an engineering executive.

Until such farming executives are developed, small-time-actors will try to play the big time and fail. Their failures will be thrown to the sky and paraded on high by the "I told you so" opponents of power farming.

In spite of such failures and such opposition, real "big time" engineering farming executives are developing here and there in the United States. Manufacturers and inventors are daily developing new and more efficient equipment for power farming, public utilities are spreading their rural electric lines like cobwebs over the country, and power farming is marching on in a way similar to the advance of power in other industries. With the agricultural engineer now getting out of his rompers and with the interest of business executives in farming, if Congress delays agricultural relief through many more sessions we hope that more efficient production will put agriculture where it does not need relief, an apparently safer thing than relief by artificial controls and barriers set up by legislative enactment. Power will do for agriculture what it has done for other industries.

A Stone Burying Project in Minnesota

By A. J. Schwantes[1]

A PROJECT to study the action of stones in the ground was started in the fall of 1926 at the Minnesota Agricultural Experiment Station.

In connection with clearing land of stones, the question of disposal often comes up. It presents a much different problem than the disposal of stumps, because stones piled up in the field will neither burn or decay.

Some way of salvaging the field stones might be worked out, but at present this method of disposing of them has not been developed. In many instances farmers are inclined to dig a large hole or a trench and bury the stones in order to dispose of them. Is this a feasible procedure? Will not the stones come back to the surface after they have been buried?

In the fall of 1926, two tracts were located, one at the Northeast Experiment Station, at Duluth, Minnesota, on a very heavy red clay soil, and the other at the North Central Experiment Station, at Grand Rapids, Minnesota, on a sandy loam soil. At each one of these locations about 14 stones were buried artificially at different depths, the depths ranging all the way from 7 feet to 6 inches, at 6-inch intervals.

A 2-inch galvanized pipe was set on the top of each stone when the dirt was placed on top of it so that it would be possible to run a level rod down through the pipe onto the flat surface of the stone and thus read the levels.

The reason for burying them at different depths is to determine the effect of frost. It is planned to take a reading of the levels of these stones each fall and each spring and to determine the depths of frost in that particular location during the winter season.

A permanent bench mark has been established at each of these locations, and these levels have been tied in with two or three other bench marks at each location.

One objection has been raised to the set-up which we have at the present time, namely, that the iron is a very good conductor and for that reason the dirt around some of these stones at great depths might freeze, which would not freeze otherwise. To overcome this objection, it is planned to put in one or more stones with a pipe consisting of some rather permanent material which would be a poorer conductor of heat, to act as a check on those which we have in at the present time.

[1]Assistant professor of agricultural engineering, University of Minnesota. Mem. A.S.A.E.

Bronze Tablet Commemorates Founding of the Society in 1907

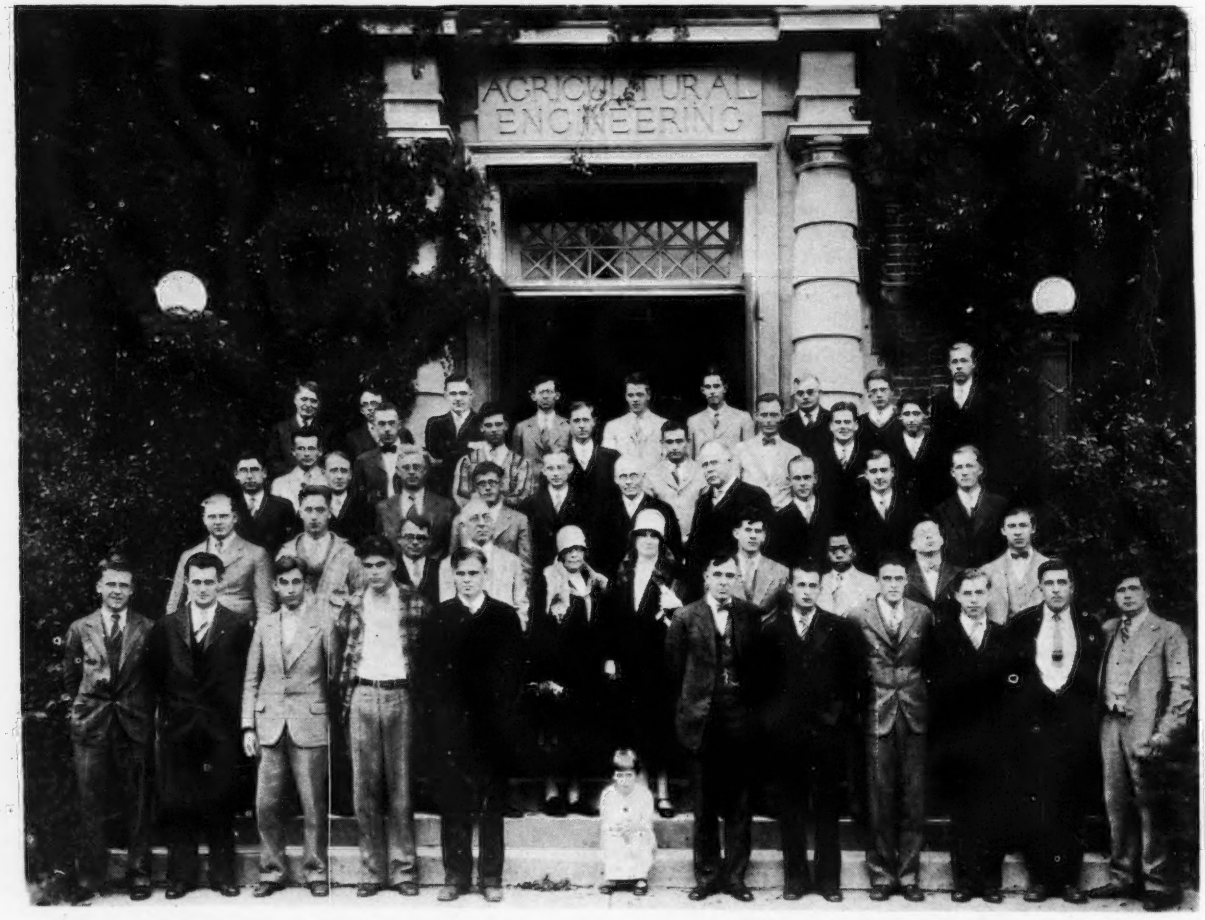
TWO score years ago seventeen men, calling themselves "agricultural engineers," met in the agricultural engineering building of the University of Wisconsin at Madison where they founded the American Society of Agricultural Engineers. That was in December, 1907. Not only did this farseeing group of pioneers found a national engineering society; they also laid the foundation for what has now come to be recognized as a distinct and essential branch of the engineering profession.

Again on October 8, 1928, a group of agricultural engineers met in the same building to commemorate the event which took place twenty years earlier, by placing a bronze tablet on the corridor wall of the building.

In presenting this memorial William Boss, president of the Society, said: "It is indeed fitting that we pause for an hour in the rush of our present day to give due recognition to an event occurring more than twenty years ago, the birth of a society which, like a newborn child, attracted but little attention at that time. But as it now enters upon the important period of its young manhood, we are extremely proud of the progress it has made and we are confidently looking forward to its future as it begins to take up its burdens of life and relieve human hands of some of the toil they have endured so long."

Mr. Boss emphasized the fact that the engineer is not thinking that he alone is to solve the world's problems, but he is offering his services and is willing and anxious to work on the same footing as other workers in helping to make the great plans and specifications for the peace and prosperity of all people. And when these plans and specifications are completed the engineer will help to build a structure based on truth and facts so far as he is able to secure them. He paid a splendid tribute to J. Brownlee Davidson, head of the agricultural engineering department of Iowa State College, who was largely responsible in initiating the organization of the Society, and who, incidentally, was its first president.

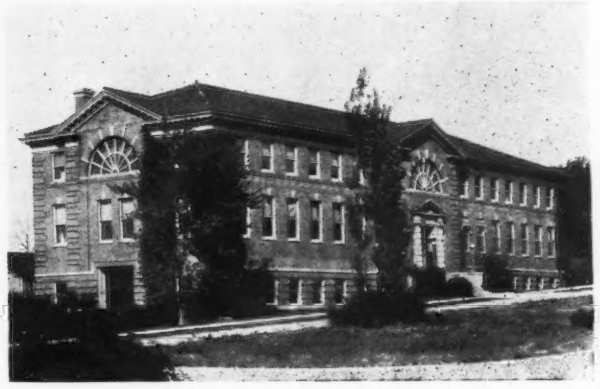
H. L. Russell, dean of agriculture of the University of Wisconsin, in accepting the Society's gift on behalf of the University, responded with a tribute to the achievements of the agricultural engineer. He pointed out the change that mechanical power and machinery has brought to modern agriculture, and what the developments in the saving of human labor mean to the future prosperity and happiness



This is the group attending the ceremony of unveiling the bronze tablet in the agricultural engineering building of the University of Wisconsin, commemorating the founding of the American Society of Agricultural Engineers in that building in December, 1907. The attendance numbering about fifty, consisted of members of the Society, including members of the agricultural engineering faculty, thirty-three major students in the agricultural engineering course at the University, and others. The tablet is placed on the corridor wall to the left of the entrance of the agricultural engineering building

This picture shows the bronze tablet in place which commemorates the founding of the American Society of Agricultural Engineers. At the left is H. L. Russell, dean of agriculture of the University of Wisconsin, and at the right is Bascom B. Clarke, a charter member of the Society and its first honorary member

Bronze tablet erected on the corridor wall of the Agricultural Engineering Building at the University of Wisconsin



The agricultural engineering building at the University of Wisconsin in which the American Society of Agricultural Engineers was founded in December, 1907

of farm people. He emphasized especially the progress that has been made in reducing the cost of producing farm crops.

In the absence of Bascom B. Clarke, one of the charter members of the Society, and the first to be elected to honorary membership, Mark D. Troxell, associated with Mr. Clarke on the "American Thresherman," the publication owned and edited by Mr. Clarke, made some interesting observations on the contributions made by engineering to the development of farm equipment and the change which this equipment is bringing about in agriculture and in farm life.

The secretary of the Society spoke briefly on the growth of the organization.

E. H. Hibbard, professor of agricultural economics, of the University of Wisconsin, addressed the gathering, giving the viewpoint of the agricultural economist on the problems of agriculture with particular reference to engineering.

R. A. Moore, professor of agronomy of the University, paid a splendid tribute to the late F. H. King, who was one of the first to be elected to honorary membership in the Society.

Basil B. Howell, a senior student in the agricultural engineering course, spoke on behalf of the thirty-three major students in agricultural engineering at the University.

E. R. Jones, head of the department of agricultural engineering of the University, opened his appropriate remarks with this significant statement: "It was an agricultural engineer, understanding both electricity and agriculture, who put into effect an extremely practical system of rural rates, fair to both farmer and utility. It was an agricultural engineer who found that 550 r.p.m. is almost as effective as 750 r.p.m. for a silo filler, yet requiring only one-half the power. It was an agricultural engineer who found a way to use sixty million pounds of war-salvaged explosives at a saving of at least ten million dollars to the farmers of this country. These examples are merely indications of the possibilities that lie immediately ahead of the agricultural engineer."

He pointed out that the aim of the engineer is to reduce the cost of producing farm crops and to increase human comforts; to increase the efficiency of labor; to press the faucet where we used to prime the pump; to turn the electric button where we used to turn the crank; to reduce by scientific design the disparity between the cost of housing the cow and the income from dairy products, and so forth. This transition, he pointed out, has taken place during the past twenty years through the efforts of a group of practical men who had a sympathy for agriculture and a knowledge of engineering, who have had their feet on the farm and their minds on mechanics.

Specifications for Domestic Refrigerators

THE establishment of national specifications for domestic refrigerators to permit their purchase on the basis of quality and performance is to be undertaken shortly by a technical committee representing manufacturers, dealers, purchasers, government departments and all other interests concerned, it is announced by the American Engineering Standards Committee, under whose auspices the work will be conducted.

A general conference called recently decided that standardization activities, for the present at least, would be devoted chiefly to ice boxes and other refrigerators which may contain units operated by gas or electricity. Indicating the great economic importance of specifications which will permit the purchase of refrigerators operating at the lowest ultimate cost, the Committee's announcement points out that twelve million domestic refrigerators, representing an annual cost for ice or its equivalent of $26 to $28 for each refrigerator, are now in use.

The need for specifications to guide the purchaser may be judged from actual tests conducted by a manufacturer on three different refrigerators of about the same size. To maintain the same temperature inside the box, one refrigerator melted 22 lb. of ice per day, another melted 28 lb. per day, and a third, 34 lb. In other words, the third refrigerator required over 50 per cent more ice than the first to maintain a proper temperature. Yet a buyer, unaware of this, might pay more for the poor refrigerator than for the good one. In another test, it was found that the use of extra insulation representing a cost of $20 resulted in a saving in ice of about $9 per year, the equivalent of an annual dividend of 45 per cent.

Advertising as it Relates to Agricultural Engineering[1]

By K. J. T. Ekblaw[2]

IF MY assumption is correct, this is the first time that this particular subject has been brought up directly for discussion before this Society. While there are probably a great many subjects of more or less direct interest to members of the Society, subjects which cannot be classed strictly as technical agricultural engineering subjects, yet whose discussion would undoubtedly be of great value and benefit to the members, I feel that advertising is a subject of a little more than usual importance. In the course of my discussion I shall attempt to indicate wherein the agricultural engineer may well devote at least some of his serious thought and possibly a portion of his reading and study to advertising.

The importance of advertising, I take it, is well appreciated by every thinking person. No apology is needed for presenting this discussion as part of an agricultural engineering program. Advertising as a profession is comparatively new and in this respect stands in the same classification as agricultural engineering. However, advertising has been done ever since industry began, just as agricultural engineering has been practiced ever since the first crops were raised. The point is that recognition of both advertising and agricultural engineering has come only recently and only when conditions in industry led to further specialization and a recognition of the need for concentrated attention upon these particular subjects.

It is not my purpose nor would it be possible for me or for anyone in a discussion as short as this to present a complete course in advertising, for advertising is a profession in itself. Years of study and training are necessary before even an ordinary understanding of its fundamental principles is reached, and an ordinary knowledge of the practical application of these principles is acquired. I would like, however, to present briefly some very general thoughts on advertising which might form a background for remarks which will follow.

Every individual can benefit by an appreciation of the power of advertising. Because advertising is an essential part of salesmanship all our endeavors may come under the classification of "Sales Activity." We are constantly engaged in an endeavor to persuade someone else to accept our ideas, our knowledge, our personality, even ourselves; this activity is in reality a form of selling. Everyone recognizes that ability to present these attributes in an attractive and forceful way is an important factor in progress and success.

The fact that the membership of this audience is made up of both theorists and practical men is fully recognized. The need for a practical knowledge of advertising is just as great for theorists as it is for practical men; the only difference being, perhaps, that the practical man recognizes this need more frankly than does the theorist.

Justification for the inclusion of a talk on advertising in an agricultural engineering program may be found in the following reason if in no other: Advertising is such an important factor in merchandising, and merchandising in turn is such an important part in the cycle of production, that some knowledge of it should be possessed by everyone who concerns himself with the processes of production.

Let me elaborate upon that statement just a bit for the sake of emphasis. Agricultural engineers are most intimately concerned with production—with the production of different kinds of crops, with the production of livestock, with the production of agricultural wealth, with the production of physical well-being for people who live on farms. Material things are involved in, and evolved from, these production processes; subjective and objective merchandising come into consideration. We have grain and cattle to sell, equipment and service to buy. In all of these commercial transactions, advertising plays a definite and prominent part and anyone who ignores it loses as a result of ignorance.

Furthermore, advertising is an educative process. Those members of the Society who are more directly concerned with teaching should recognize in advertising a method of mass education and give it credit as such. New facts of interest and value to large groups are most rapidly disseminated by means of properly directed advertising. Since advertising may be done in different ways that vary in value, according to field and fact, it is desirable to be able to use the most direct and resultful method.

Advertising as a merchandising and educational force cannot be ignored. As I said before, everyone advertises either consciously or unconsciously and it is a good thing to do it well. Conservative estimates indicate that there are at least 10,000 firms that are doing more or less successful advertising of a more or less national extent. In addition to these, there are many, many thousands of organizations that do only a limited amount of local advertising. Yet the cumulative effect of all these is tremendous. One often hears rather remarkable stories about the stupendous sums expended by national advertisers, and, indeed, there are many whose advertising bills run into millions of dollars. I hesitate to give any figures in regard to the actual total expenditures of individual advertisers because authorities vary. One very conservative authority says that there are at least fifty advertisers who spend $250,000 or more, fifteen hundred who spend $10,000 per year or more.

We may find in the growth of periodicals a measure of the growth of advertising though, of course, periodical advertising is only one of many ways in which advertising money is spent. Benjamin Franklin wrote in 1771 that "my brother had in 1720 or 1721 begun to print a newspaper. It was the second that appeared in America. At this time, 1771, there are not less than five and twenty."

"I remember his being dissuaded," says Mr. Franklin, "by some of his friends from the undertaking as not likely to succeed, one newspaper being in their judgment enough for America."

What do you suppose the advisors of Franklin's brother would have said had they been alive a hundred years later and had seen 800 newspapers circulating in the United States? Or if they could have lived still another 100 years and had seen a directory four inches thick listing 25,000 periodicals in this country alone?

What would they have said if someone had told them that within 200 years more than one billion dollars would be spent annually for advertising? What would they have said about using up 3,000 square miles of space for advertising as is being done now each year—an area more than forty times as great as this District of Columbia in which we have been holding our meeting?

I have said that advertising is a force that cannot be ignored. Let me tell you a funny story, which is absolutely true and which indicates how seriously advertising must be taken.

You have all heard of the famous get-rich-quick cat ranch story in which an enterprising California organization planned to start with 1,000,000 cats; each cat to average 12 kittens per year. The cat skins would sell for 30 cents each which figured a daily net profit of some $10,000. The question arose as to what the cats should be fed. This was answered by the plan to start a rat ranch next door with 100,000,000 rats, which would breed 12 times faster than the cats. The food supply for the cats being settled, how about

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[1]Paper presented at the 22nd annual meeting of the American Society of Agricultural Engineers held in Washington, D. C., June, 1928.

[2]Consulting agricultural engineer, Frank B. White Company. Mem. A.S.A.E.

the food supply for the rats? Very simple—feed the rats the carcasses of the cats after they have been skinned.

A prominent bank in one of our largest cities placed a poster in their window in which the outline of this tremendous livestock promotional scheme was given. The poster announced that shares were selling at five cents each, but that the price would go up soon and investors were to take advantage of the opportunity immediately. Furthermore, the poster carried the statement, "Some gullible people will try to buy this stock. It is a foolish fake, of course, but no more foolish than many other wild cat schemes today. Investigate before investing. Don't hand your money over to any unknown glib-tongued salesman."

According to the "American Magazine," which gave the story of this incident, immense crowds gathered in front of the window and numerous inquiries for the stock were made by mail and in person asking about literature of the company. In fact, the inquiries became so numerous as the result of the advertising which was developed that the bank had to remove the card and try to forget the unexpected serio-comic results which came from a thoroughly serious intention.

Advertising is the art and science of making things known. We should like to say of making "facts" known, but unfortunately sometimes advertising is used to make untrue things known. By that we mean advertising is such a widely accepted method of fact dissemination that people get into the habit of believing that everything that is said in advertisements is true.

This leads us to the real reason for the existence and development of advertising—its power as a factor in merchandising. It helps to sell. In that respect it has a real monetary value; it affects our pocketbook—well-directed advertising helps to fill it or at least to keep it from emptying so rapidly. When anything helps to maintain a well-packed pocketbook, it becomes of great importance immediately.

Even the person who has never directed a single conscious thought toward advertising as such must recognize the influence of advertising in the commercial field. It has great power in influencing the mind. Many a sale is made almost exclusively by advertising. For example, a farmer may be contemplating the purchase of a tractor. His first thought of a tractor may have come from seeing an advertisement in his farm paper. Through the advertisement he learns of the advantages which result from the use of the tractor. Turning his thought over in his mind from day to day and having it reinforced with further arguments which appear in succeeding advertisements, he is finally convinced that he can farm better with a tractor, make more money with it and then proceeds to the dealer to make the purchase. Other influencing factors may have entered, but the fact remains that advertising was responsible for the sale. It is this very thing that makes advertising powerful. Of course, there are many different forms of advertising, but their general influence is all the same.

Advertising is a very human thing. It is largely psychological in its application and its effects. No one can qualify as an advertising expert unless he has a good ground in theoretical and practical psychology, a thorough understanding of human nature. Practically every advertising question requires a knowledge of psychology.

When an advertising campaign for any product comes up for consideration, a number of questions immediately arise.

Who will buy? is the first one. The answer to that question must be based on the knowledge of the buying habits of various classes of people.

Why will they buy? The answer to this question again depends upon an intimate knowledge of human nature.

How can they best be reached? Here a combination of knowledge of human nature and of markets is necessary.

Through what mediums? Different classes of people read different kinds of mediums. The choice of the mediums then immediately becomes a study of mental processes.

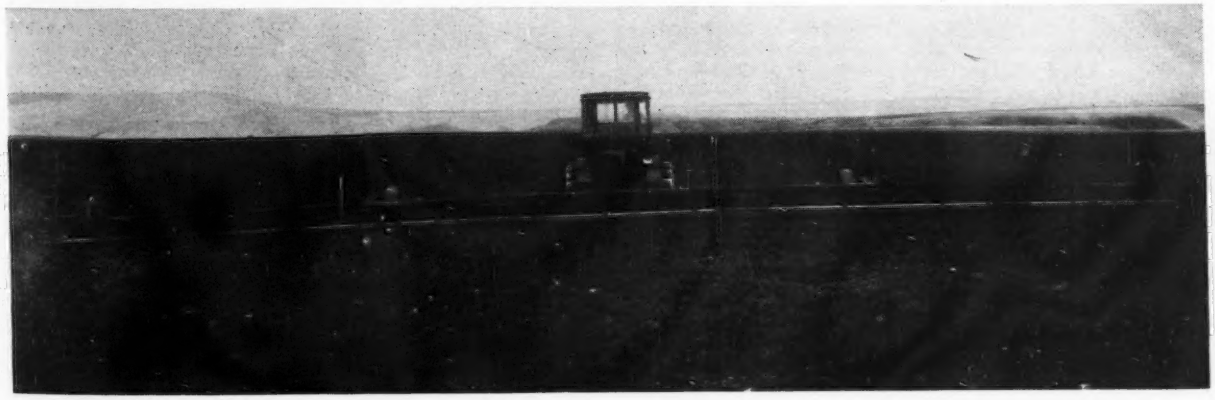
At what justifiable expense? This exceedingly important question is most closely connected with all the matters of money involved in the campaign. For it is not impossible to spend money unwisely in advertising and the amount that can be wisely spent will depend upon the effective results which can ultimately be produced; only a knowledge of buying habits can give an indication in this respect.

Occasionally there are rather vigorous objections brought against advertising, some of which at times appear to be made with more or less justice.

By some, the expense of advertising is severely criticised. These critics know that space in important publications costs a great deal of money and when they see a simple message spread across a couple of expensive pages, it violates their ideas of economy. As a matter of fact, while great sums are spent for advertising, the returns of well-directed advertising thoroughly justify these expenditures.

Advertising is sometimes charged with being responsible for increasing the unwarranted purchase of luxuries and semi-luxuries. This has been true particulary in recent years when the farmers' standard of living has been steadily going up. It has been often said that the farmer has been spending too much money for phonographs, radios, automobiles, tractors, electric lighting plants and other items of equipment which we as agricultural engineers endorse; these same critics have condemned farm periodicals for carrying advertising of these products. The logic of such criticism is hard to follow.

It has been charged that advertising develops fictitious values, that the expense of intensive advertising to increase consumption above normal has to be added to the selling cost, and that the consumer has to pay the penalty. This brings up the question of who pays the cost of advertising, but that need not be elaborated upon here. It is a comparatively easy matter to cite instances which prove that while advertising expenses may be included in selling expenses, properly directed advertising reduces sales costs so that the



. Cultivating wheat with a 70-foot spread of spring-tooth harrows

consumer realy gets his commodities cheaper than he would get them if they were not advertised.

The answer to the foregoing question also covers a fourth common objection to advertising, that it increases expense of distribution. Actually the exact opposite is more likely to be true. That is, the more widespread the advertising, the greater the distribution and the lower the cost of distribution per unit.

In spite of the arguments against advertising and in spite of the objections to it, advertising justifies itself by its own existence. Were there not a real need, a real demand for advertising, certainly it would not have been initiated nor would it have been possible for it to have developed to the enormous extent which it now reaches nor to the substantial position which it occupies. Critics of advertising must acknowledge its power, its ability and its influence. It is a measure of progress. It is not too much to say that one reason why advertising has grown is that people want to be advertised to; they want more information and they have learned that certain kinds of information can most easily be obtained through the avenues of advertising that are outlined today.

Of course, we must recognize that advertising may be destructive as well as constructive. In any profession there is a constant evolution of methods and practices and this is as true of advertising as of any other profession. Inasmuch as advertising has come to its present estate comparatively recently we cannot expect that all advertising methods and practices are perfect.

Advertising is not an exact science—it cannot be, so long as psychology and the human equation enter into it. The best the advertising specialist can do is to apply himself assiduously, work hard and earnestly, accumulate data and experience and use his soundest judgment and wisdom in applying it for the benefit of his client. With the changing world, advertising principles and practices must change. What was cor s'dered good twenty-five years ago or a year ago may have been found by this time to be wrong. That is the price of progress.

It is a fact, however, that advertising as a whole has been powerfully constructive. It has been responsible for tremendous expansions of industries. It has carved for itself a place as a profession. Any destructive influences which advertising may have exerted have come more as a result of ignorance than anything else because willfully destructive advertising is practically an impossibility. An advertiser or his agent could no more project a willfully destructive campaign than a doctor could murder his patient.

Of course, in the heat of strongly competitive advertising argument unwarranted assumptions may sometimes be made, statements may be based on inadequate data or undesirable influence may be brought to bear. The advertising profession frowns upon anything of this kind and has set up agencies for the strict policing of its own preserves; and these agencies operate with justice and impartiality.

To conclude this general delineation of the advertising entity, let me present in summarized form four essentials of good advertising:

Advertising must justify itself. It must present a real advantage of the article which is being advertised. In other words, the article advertised must possess features which justify its being marketed and which justify the consumer in purchasing it. If an article is inferior or unnecessary, advertising it must be unsound and unjustified.

The advertising story must be told simply, without superSecond, advertising must be straightforward and specific. latives, without circumlocution. Verbosity in advertising copy is the apex of asininity.

Next, advertising must be pertinent and relevant. The facts presented must be of real and obvious value. Deviation from the subject is a crime in advertising for it wastes the reader's time and the advertiser's money.

Finally, advertising must be absolutely truthful. "How powerful are right words!" says Job. Unfortunately, the quality of truthfulness is not always possessed by advertising, but we are happy to say that veracity is on the up-grade. In the early days of merchandising, caveat emptor was the rule, "Let the buyer beware." This rule held as strongly in all trades as it did more recently in horse trades. But conditions are changing and now, "the customer is always right" is more commonly heard.

If these four principles are used as the criterion for judging advertising, if the four essentials which have just been enumerated are made the standard for the preparation of advertising, it will possess the appeal and conviction so necessary to make it successful.

There are two distinct viewpoints from which agricultural engineers should look at advertising and which constitute the main reasons why they should be interested in the subject.

First, to advertise agricultural engineering as a profession, to advertise themselves as members of it, and to advertise the American Society of Agricultural Engineers as their recognized official group organization. The interests of the profession, the Society and its members are promoted by developing and encouraging a more accurate and a more general recognition of agricultural engineering activities.

Second, to promote advertising as an educative process with particular reference to the development and exploitation of the products and professional practices of agricultural engineers. A new implement is manufactured, a new system of ventilation is perfected, or a new principle of drainage is discovered—at least part of the work of acquainting farm operators with the new facts belongs legitimately to advertising.

A discussion of the first viewpoint of advertising as just outlined immediately brings up the question of ethics. We admit that the best professional development cannot occur without a sound and sensible code of ethics. But who is to prescribe a code of ethics which will stand the test of time and changing conditions? If we can fairly assume that the average agricultural engineer is honest and that he lets his conscience and his common sense be his guide, then we do not need to worry about the lack of any formally pronounced principles of professional behavior.

In an audience of this knd I recognize that there are some whose commercial perspective has been unfortunately and seriously fore-shortened by too close a following of academic ideals. Such a development almost always occurs to a greater or less extent in an environment that is almost exclusively educational.

I recall the statement of a famous civil engineering professor some fifteen or twenty years ago to the effect that "agricultural engineering is neither flesh, fish nor fowl," and he spoke contemptuously of those who were endeavoring to place it upon its own basis as a branch of engineering as definitely outlined as civil engineering itself. I only wish that the present development of agricultural engineering could have been pictured at that time for this gentleman's benefit.

The same contemptuous attitude toward various phases of a commercial activity, advertising included, obtains today in certain quarters. I only wish that I could portray with sufficient vividness the correlation of academic and commercial activities which I am sure will develop in the near future so that I might convince our present scornful critics of their warped and shortsighted vision.

Unfortunately, it has often been the tendency of the older professions to consider advertising as unethical, undignified and unworthy even of small attention. If the points which I have brought up have any merit whatever—and I feel they most certainly have—then they not only deserve recognition by every agricultural engineer whether he be academic or commercial in his inclination, but they deserve earnest consideration.

There is a need for more publicity about agricultural engineering. Agricultural engineering is coming to be an increasingly powerful factor in agricultural development and it is our plain duty to bring about in various logical and legitimate ways a stronger appreciation of what can be done through the services of the profession. It is not my purpose to outline detailed methods of spreading agricultural engineering propaganda, but I do think we can profit by the experience of others and often follow their example with good results.

As individuals we can make sure that our technical training is such as to make our educational and research work sufficiently high in quality to command the respect of other branches of engineering and of agriculture. We have been criticised for lack of quality and I am frank to say that the

criticism was not only justified but that the same criticism would be justified today.

We can put quality into our professional writings. We can prepare articles that will be considered authoritative. We can use thought in preparing our public expressions so that they will incite respect.

I marvel at the tremendous progress which the agricultural engineering profession has made and is making in the direction of improved quality of performance. We have only to compare the quality of the material which appeared in the first issue of the Society's transactions with the quality of the papers now constantly appearing in our magazine, AGRICULTURAL ENGINEERING, to find a measure of the tremendous progress which has been made. This does not mean that the pinnacle has been nearly approached; for the hill of progress is an exceedingly long one, some of its grades are exceedingly steep and we have just begun the ascent.

Of course, it is the privilege of the individual to circumscribe his own development. I sincerely hope, however, that every member of the American Society of Agricultural Engineers assumes a personal responsibility to grow and expand, for from such growth and expansion the Society itself will develop a greater usefulness and the profession will gain a greater prestige.

But we must let the world know about it. Hiding our light individually or as a Society under a bushel will benefit neither us nor the agricultural industry to which we owe a distinct obligation. To put it very plainly, we must advertise. Let us admit it frankly.

Now, to take up the second important agricultural engineering viewpoint of advertising, let us consider what can be accomplished by advertising as a means of education.

To what extent does every agricultural engineer share in advertising? We cannot measure it—we can only indicate it. The individual engineer must look at advertising and consider it not only from his own standpoint, but from that of the industry of which he is an essential and important part, and from the standpoint of the consumer who looks to the agricultural engineer for advice and guidance.

The agricultural engineer certainly is interested in progress. It is the keynote of his own development. Education promotes progress. Since advertising is an educative force it must promote progress; therefore, the agricultural engineer has a real and vital interest in it.

In order to make the best use of advertising as a method of education, the agricultural engineer must have some knowledge of the practical routine and organization of advertising activities. He should know what an advertising agency is and does. He should appreciate the need for it as a separate and distinct business which has developed mainly as a result of specialization in merchandising. He should know how an advertising agency renders its service through the making of surveys, the development of ideas, the preparation of copy and art work, and all the multitudinous details which are involved in all these expressions of salesmanship through the printed word.

The publicity given the general purpose tractor is showing results in the increased application of engineering to agriculture and in lower farm production costs

Then he will begin to realize the complexity of some of the problems which engage the advertising specialist's attention. He will understand why it is necessary at times to make a survey of the field to be covered, a survey which may be designed to answer one or a dozen questions. He will understand something of the importance of the weighty matters involved in deciding upon the type of appeal, the character of the copy and the quality of the art work. The engineer in the advertiser's organization may insist that the consumer must be told of the mechanical details of the product advertised, yet the man in the field who is selling may know that the consumer cares not at all about the mechanical construction but wants to know about results.

The layman will then begin to appreciate the economic side of advertising, how it increases sales and turnover and thereby increasing profits. He will begin to appreciate some of the reasons for the high cost of distribution and may even be inspired to devote some of his attention to a study of methods to reduce this high cost.

I cannot go into great detail on this phase of the subject because it is so extensive in its field and so far reaching in its applications. Volumes upon volumes have been written about this very thing and it is impossible even to give an abstract of it now.

I hope that I have created some slight interest in advertising as a phase of merchandising and that I have shown in some way or other how the agricultural engineer may plan an important part in the developments which are certain to occur in the future.

If the agricultural engineer asks himself, "What have I to do with advertising?" or, "What has advertising to do with me?" let him but look at some of the great agricultural movements which have been made in recent years. Let him analyze the corn borer campaign—let him see what a tremendously important part publicity has played in it. Let him recall the history of the ventilation of farm buildings and the part that the dissemination of information has played in that. Let him study the development of the silo and the great publicity and advertising efforts which were of such influence in bringing about the construction of hundreds of thousands of silos now on American farms. Let him view the present great change in harvesting methods—the advance of the combine and the extension of its use.

These are but a few of the great forward movements in agriculture. They cannot proceed without a great amount of publicity and legitimate propaganda, which is advertising, if you please.

If the agricultural engineer wants practical proof of the relative importance of agricultural equipment advertising, let him look in the columns of our farm periodicals. In twelve of our leading state farm papers all issued upon the same day this spring, 55 per cent of all the advertising carried was advertising of agricultural equipment, the physical equipment of the farm; in the design, construction and distribution of which the agricultural engineer must be vitally interested.

When I first outlined this discussion I had in mind including within it a presentation of facts and data relating to agricultural equipment advertising, a sort of a report of projects carried on within the advertising laboratory; but as the outline developed and as I talked with others who were interested in the subject it appeared to me that perhaps for this first discussion of advertising before the Society, it would be better to be more general. Let me say that there is a multitude of agricultural equipment advertising problems yet to be solved and I sincerely hope that they may in some degree engage the future attention of the membership of the Society.

Our advertising service, however, must be guided by an intimate and accurate knowledge of both agriculture and of engineering, for the measure of our success will depend upon quality of the service we render. Only conscientious research and analysis will give us the facts upon which to base an honest and acceptable advertising service.

Purdue Holds Second Rural Electric Short Course

REPRESENTATIVES of nine states to the number of one hundred and twenty-two registered for the short-course for rural electric service men held at Purdue University, October 17 to 19, 1928. The large increase in attendance over the one held in 1927 very probably serves as an indication of the awakening interest in the how, where and why of the use of electricity on the farm. The course held under the direction of the Agricultural Engineering Department of the Purdue Agricultural Experiment Station with the cooperation of the Indiana Electric Light Association, served to formally initiate the new agricultural engineering building where the meetings and exhibits were held.

The short-course which was the second of its kind held at Purdue differed from that held in 1927, the first one in the United States, in that exhibit space was allotted in the new building to those manufacturing companies who cared to send equipment and representatives. This added feature served to provide a full day for those attending the course as well as to enable them to inspect electrical equipment especially designed for farm operation. Twenty-six manufacturers sent equipment to the short-course and representatives to display it.

The program of the short-course was made up of lectures during the first two days by members of the staff of the agricultural experiment station with an evening meeting on the second day. The morning of the third day was devoted to papers on methods of merchandising equipment to the farmer, followed by round table discussion. The final afternoon was allotted to demonstrations of electrical equipment and inspection of experiments in progress.

The possibilities of the load offered by feed grinding on the farm were discussed in two papers, one dealing with the value of grinding roughage for dairy cattle by a member of the dairy husbandry department and the other with grinding grain for livestock by the head of the animal husbandry department. I. D. Mayer of the agricultural engineering department discussed the power requirements and capacities of motor-driven feed grinders.

Subjects related to the use of electricity in poultry production were discussed in three papers by two members of the poultry husbandry staff. Problems encountered in electric brooding, results of tests on electric water heaters for poultry and the use of electric illumination to increase winter egg production were topics discussed.

Other topics on the program were concerned with fuels for cooking by a member of the home economics staff, refrigeration for the farm dairy by a representative of the dairy department, electric heaters for seed corn germinators by one of the agronomy staff, and the use of electric current in the vegetable garden, greenhouse and hotbed by a horticulturist. Talks by an Indiana farmer and an Indiana farmer's wife on the value of electric service to them, together with a talk by the chairman of the Rural Service Committee of the Indiana Electric Light Association opened the program.

The question of merchandising equipment by utility companies was the subject discussed by the commercial manager and rural service man of a utility company as well as the sales manager of a manufacturing company from the respective viewpoint of each. The round-table discussion following disclosed many methods of handling this matter at the present time. Demonstrations of motor-driven ensilage cutters, feed grinders, milkers, animal groomers and clippers with an inspection of the University poultry plant completed the short-course program.

Standard Plans for Housing Combine and Tractor

ENGINEERS of the National Lumber Manufacturers Association, Washington, D. C., have designed a standard set of plans for housing farm machinery. A twofold set of plans has been developed, one for a combine, tractor, and farm implement building and the other for a combine and tractor shed with farm shop. Sound construction, convenience, serviceability, and economy were considered essentials in drafting these plans and the bills for materials to accompany them. They are made available on request to those interested in them and may be secured from the association's office in Washington or any of its offices in the larger cities.

This is the group attending the short-course for rural electric service men held at Purdue University in October. The picture is taken in front of the new agricultural engineering building erected this year at Purdue

Agricultural Engineering Digest

A review of current literature on agricultural engineering by R. W. Trullinger, specialist in agricultural engineering, Office of Experiment Stations, U. S. Department of Agriculture. Requests for copies of publications abstracted should be addressed direct to the publisher.

Evaporation on United States Reclamation Projects, I. E. Houk (American Society of Civil Engineers Transactions (New York, N. Y.), 90 (1927), pp. 266-378, figs. 26).—In a contribution from the U. S. Bureau of Reclamation a summary is given of the evaporation investigations made on U. S. reclamation projects. The necessity for considering meteorological conditions in applying evaporation data is shown by a diagrammatic comparison of records at the two Yuma stations.

The evaporation from a land pan, 14 in. deep and 3 ft. square, set in the ground with earth banked around the sides, was found to be only 72 per cent of that from a Class A land pan, 10 in. deep and 4 ft. in diameter, set on the ground with no earth around the sides. The evaporation from a land pan on the ground at the edge of an alfalfa field was found to be only 62 per cent of that on a tower 11 ft. above the ground. The evaporation from a floating Class A pan mounted on a raft was 67 per cent of that from a similar pan on land.

Sloshing troubles in floating pans were partly eliminated by installing a sheet-iron honeycomb in the lower part of a pan, thus dividing it into compartments. Measurements of ice evaporation showed daily rates of from 0.01 to 0.07 in., the mean temperatures varying from about 9.6 to 31.1 deg. F.

The Effect of Agricultural Drainage Upon Flood Run-Off, S. M. Woodward and F. A. Nagler (American Soceity of Civil Engineers (New York, N. Y.) Proceedings, 54 (1928), No. 1, pt. 1, pp. 165-183, figs. 10).—A critical examination of the records of flow in the watersheds of the Des Moines and Iowa Rivers, made by the University of Iowa, is reported, showing that during flood periods there has been no significant change in the behavior of these streams which may be attributed to drainage. The total run-off from storms of like precipitation, the maximum rates of discharge, and the rain-water storage conditions within the basins seem to have been unaltered by the extensive drainage operations. It is to be noted that the drainage operations on the watersheds of these two rivers have involved the construction of tile drains, open ditches, and some straightening of stream channels.

The results of this investigation are taken to indicate, therefore, that agricultural drainage has had a negligible effect upon the magnitude of either the total flow or the maximum discharge of the floods of the Mississippi River.

The Condition of Field Specimens of Concrete Exposed to Alkali Soils and Waters Examined in December, 1927 (Engineering Journal (Montreal) [Canada], 11 (1928), No. 3, pp. 184-192).—The data from these examinations are tabulated and briefly discussed.

Hydrostatic Uplift in Pervious Soils, H. de B. Parsons (American Society of Civil Engineers (New York, N. Y.) Proceedings, 54 (1928), No. 4, pt. 1, pp. 941-956, figs. 6).—This paper describes a study to determine the hydrostatic uplift on the base of a structure founded on a pervious soil when there is no loss of head due to velocity of flow. A record is presented of 218 tests with sand, gravel, and clay under both low and high hydrostatic heads.

It was found that shallow depth of soil under the test base affects the results. The results also show that the effective area, or that portion of the base on which the uplift acts, is approximately from 90 to 100 per cent according to the test conditions. The apparatus used and the methods of conducting the tests are fully described and illustrated.

[Irrigation Studies at the New Mexico Station] (New Mexico Station (State College, N. M.) Report. 1927, pp. 23-32, fig. 1).—The progress results of ground water studies in the middle Rio Grande Valley, N. Mex., of duty of water investigations, of studies of the rate and cause of rise of ground water in the Mesilla Valley, of studies of duty and effect of duty of water on alfalfa, studies of the water requirements and economical use of water for cotton and other crops, and of studies of rainfall supplemented by underground water in the production of crops of low water requirements, all conducted in cooperation with the U.S.D.A. Bureau of Public Roads, are reported.

Delivery of Irrigation Water, W. A. Hutchins (U. S. Department of Agriculture, Technical Bulletin 47 (1928), pp. 48, figs. 11).—Data are reported from a study of the delivery methods and other important phases of the management of nearly 100 irrigation enterprises in 13 of the 17 western states. Projects of four principal types were included, namely, mutual companies, irrigation districts, commercial companies and federal projects. Districts and mutual companies together included about 75 per cent of the total.

Bacteria in Creamery Wastes, M. Levine and L. Soppeland (Iowa Engineering Experiment Station (Ames, Iowa) Bulletin 77 (1926), pp. 72, figs. 8).—A systematic study of the organisms isolated from artificial creamery wastes is reported in which 36 species were described. A key for their identification is also presented. Strict anaerobes were found to be very rare, only one of the species being in this category. All of the other species were facultative and usually grew much better aerobically. More than half of the species were proteolytic, and digestion of the casein was retarded by acidity and the absence of air. In the presence of an abundant air supply acid production was depressed and proteolysis was markedly favored.

Tests Show Divining Rod Worth Nothing, J. W. Gregory (Water Works, 67 (1928), No. 2, pp. 81, 82).—The results from different sources of tests of divining rods for locating underground water supplies are summarized. These indicate as a whole that the divining rod has no merit in this connection.

The Dry Treatment of Grains with Fungicides, Using Continuous Dusting Machines [trans. title], G. Friedrichs (Fortschr. Landwirtschaft, (Berlin) 3 (1928), No. 2, pp. 58-66, figs. 5).—Comparative tests of a number of continuous dry dusting machines for grains are presented and discussed.

The results are taken to indicate that the problem of continuous treatment of grains with fungicides is not yet completely solved. However, there are machines for intermittent treatment which give good results. The principle of the continuous mixing of grain and dry fungicides does not present as great difficulties as the addition of both materials. It appears necessary to add the dry fungicide in fine dust form in the same stationary tubes through which the grain is introduced. The dust, however, hinders the entrance of the grain, which difficulty has apparently not been overcome.

Clays: Their Occurrence, Properties, and Uses, H. Ries (New York: John Wiley & Sons; London: Chapman & Hall, 1927, 3. ed., rev. and enl., pp. VII + 613, figs. 173).—This book contains chapters on the origin and occurrence of clay; minerals in clay; chemical properties of clay; physical properties of clay; kinds of clays, including bentonite and fuller's earth; distribution of clays in the United States—Alabama to Louisiana, Maine to North Carolina, and North Dakota to Wyoming; and distribution of clays in Canada.

Some of the material contained should be of interest to agricultural engineers engaged in the study of soil dynamics.

Technology in the Agriculture in the United States of North America [trans. title], G. Kuhne Ber. Landw. Reichsmin. Ernahr. u. Landw. (Berlin, Germany), n. ser., Spec. No. 3 (1925)), pp. [4] + 100, figs. 99).—The results of a survey of agricultural engineering practices in this country, made from the German viewpoint, are presented in considerable detail.

Equipment for Swine Production, B. M. Anderson and V. R. Hillman (Kansas Station (Manhattan) Bulletin 243 (1927), pp. 46, figs. 32).—It is the purpose of this bulletin to enumerate a number of essential and desirable features of swine production equipment and to describe and illustrate a variety of buildings and equipment that have proved practical on Kansas farms and elsewhere. A number of working drawings and bills of material for specific structures are included, together with a list of available building plans.

Effect of Shape and Character of Coarse Aggregate on Strength of Concrete, F. C. Lang (Concrete [Chicago], Cement Mill Edition, 32 (1928), No. 3, pp. 37, 38, figs. 6).—An account is given of tests of a variety of aggregates to determine their behavior in concrete. With the same water-cement ratio the slumps for various aggregates were, smooth gravel 6⅝ in., commercial gravel 4¾ in., limestone 4 in., trap 2¼ in., and sandstone 4⅝ in. The smooth gravel gave the lowest results in both compression and transverse tests, and the 28-day results shown by sandstone in the transverse test were low. The slump test indicated that the smooth gravel can be used with less water.

The Influence of the Earth Floor Upon the Humidity of Common Storages and the Resultant Keeping Quality of Fruit, L. M. Marble (American Society of Horticultural Science (College Park, Md.) Proceedings, 23 (1926), pp. 315-321, pls. 3, figs. 3).—Studies of the effect of introducing dry air once in 24 hours, once an hour, and 4 times per hour into desiccators in which Wagener,, Baldwin, and Northern Spy apples were stored gave unsuccessful results because of the respiration moisture. With the Baldwin, even with one change per day the average humidity was 96 per cent. Northern Spy and Baldwin kept in good condition in the desiccators until February 20, while Wagener completely disintegrated.

Records taken on the weight loss of Baldwin apples stored in a bank cellar and in an above-ground chamber showed in February losses of 5.5 and 3.35 per cent, respectively. The average humidities were 74.2 and 85.6, respectively. Visible shrinkage was not apparent in either lot by February 20, indicating that for apples sold during the early part of the storage season quite wide differences in humidity relationships may be tolerated. However, in April and early May the above-ground stored apples were noticeably in better condition.

Damp Outer Walls and the Moisture Given Off by Them [trans. title], H. Bernstein (Gsndhts. Ingen. (Munich, Germany), 50 (1927), No. 32, pp. 585-588, figs. 5).—Experiments with brick, limestone, and concrete walls, dry and saturated, are reported, the purpose being to determine the absorptive powers for moisture of these materials and their ability to give off moisture in a room of known temperature, humidity, and air movement. The brick was found to absorb twice as much moisture as the concrete and half again as much moisture as the limestone. However, the percentage of voids filled in the brick was considerably less than that of those filled in the cement. Several different methods of measuring the escape of moisture from the walls were used, the apparatus of which is described. The data are presented graphically and no conclusions drawn.

Factors in the Management of the Ice Cooled Refrigerator in the Home, R. Jordan (Indiana Station (Lafayette, Ind.) Bulletin 316 (1927), pp. 32, figs. 5).—The results of investigations are presented which indicate that the temperature in the food chamber of a refrigerator rises rapidly after the ice has melted to below half the capacity of the ice chamber. Frequent opening of the doors of the refrigerator, loading the food chamber to capacity, and high outside temperatures are factors which cause an increase in ice consumption and also a rise in the temperature in the food chamber.

It was found that in a side icing refrigerator the temperature at the top shelf may be 8 deg. F. or more higher than that part of the food chamber underneath the ice chamber. It appears that this difference in temperature is sufficiently great to make a considerable difference in the time in which certain foods spoil.

American Greenhouse Construction, R. T. Muller (New York: A. T. De La Mare Co., 1927, pp. VIII + 143, figs. 55).—The information presented in this book appears to be gained primarily from the results of investigations at the Massachusetts Agricultural College. Chapters are included on essentials of a greenhouse; structural materials; types; arrangement of greenhouse range; instructions for erecting semi-iron frame houses; ventilation, painting and glazing, shading, glass, brackets, benches, beds and walks; heating systems; boilers; fuels; frames and storage pits; and glass structures for amateurs.

Prolonging the Life of Tobacco Shade Tent Poles, H. W. Hicock and P. J. Anderson (Conecticut State Station (New Haven, Conn.) Tobacco Substation Bulletin 9 (1927), pp. 12, figs. 6).—The results of an investigation on the application of preservatives to tobacco shade tent poles are presented, and methods of practical procedure are described. Attention is drawn to the fact that 350,000 chestnut poles are used to support the tobacco shade tents of the Connecticut Valley. Most of the native species suitable for this purpose are naturally nondurable in contact with the soil. It has been found that the durability of poles can be greatly increased by the use of preservatives to keep out the organisms causing decay. Coal tar creosote or some product derived from it is the best material to use. Immersing the butt of a pole in a hot bath at a temperature of 220 deg. F. and then in a cool bath at a temperature of 100 deg. has been found to result in the absorption of about 0.5 gal. of oil and in a penetration of from 0.5 to 1 in.

The Industrial and Artistic Technology of Paint and Varnish, A. H. Sabin (New York: John Wiley & Sons; London: Chapman & Hall, 1927, 3. ed., rev., pp. XI + 459, pls. 9, figs. 9).—This is the third revised edition of this book containing chapters on early history, varnish—origin of the name, linseed oil, linoleum, manufacture of varnish, tung oil, japans and driers, rosin, spirit varnishes, pyroxylin varnishes, oil paints and paints in japan, varnish or enamel paints, Chinese and Japanese lacquers, protection of metals against corrosion, water pipe coating, ship's bottom paints, ship and boat painting, carriage painting, house painting and furniture varnishing.

Book Review

"Reports and Proceedings of the Joint Committee on Fertilizer Application, 1925-28," is the title of a booklet compiled by E. Truog and Ove F. Jensen and published by the National Fertilizer Association. The American Society of Agronomy, American Society of Agricultural Engineers, National Fertilizer Association and National Association of Farm Equipment Manufacturers were represented on the committee and cooperated in a study of methods and machinery for applying fertilizer. E. R. Gross, chairman, E. V. Collins and R. B. Gray constituted the sub-committee representing the American Society of Agricultural Engineers. The material is in the form of a progress report, various proceedings and sub-committee reports, but no general report of the main committee, being given. An extensive bibliography on methods of applying fertilizer is included.

"The Cost of Comfort," is a handbook on the economics of dwelling insulation issued as Chapter 11, Vol. IV, of the Construction Information Series published by the National Lumber Manufacturers Association. It is prepared to give architects, engineers and prospective builders data on heating costs. With the data given and a consideration of local costs and weather conditions the prospective builder can get an idea as to what type of construction will give him maximum insulation per unit of cost. Line drawings illustrate the various types of floor, wall and roof construction on which data are given.

A.S.A.E. Officers, Divisions, Committees and Sections

Officers and Council, 1928-29

William Boss, President, University Farm, St. Paul, Minn.
Geo. S. Knapp, First Vice-President
W. C. Harrington, Second Vice-President
Raymond Olney, Secretary-Treasurer, St. Joseph, Mich.
M. L. Nichols, Councilor
A. H. Hoffman, Councilor
Geo. W. Kable, Councilor
O. W. Sjogren, Junior Past-President
O. B. Zimmerman, Junior Past-President

Nominating Committee

J. B. Davidson, Chairman, Ames, Iowa
Dan Scoates G. W. McCuen

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AGRICULTURAL ENGINEERING

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Contributions of interest and value, especially on new developments in the field of agricultural engineering, are invited for publication in this journal. Its columns are open for discussions on all phases of agricultural engineering. Communications on subjects of timely interest to agricultural engineers, or comments on the contents of this journal or the activities of the Society, are also welcome.

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RAYMOND OLNEY, Editor

The Research Attitude

REFERRING to it as a "noteworthy gathering" in several respects, one being the prominence given to research, the comments of the leading editorial of the October 1928 issue of the "Experiment Station Record," on the 22nd annual meeting of the American Society of Agricultural Engineers held in Washington last June, will be of particular interest to agricultural engineers. It is pointed out that the Society "has for some time been devoting a considerable share of its energies to the promotion of research, despite the fact that this phase of its work has been the immediate vocation of a comparatively small portion of its membership."

The editorial further states that "the Society probably devoted over a third of its time to problems of interest from this (research) standpoint. This is a goodly proportion under the circumstances, and the fact that so much of it was spent in a constructive way, is even more encouraging. Such a policy broadly planned and consistently developed should prove very useful. It well exemplifies substantial aid to research which professional groups may render under leadership which is both interesting and enlightening."

This tribute to the efforts the Society has made to feature research in agricultural engineering will be thoroughly appreciated by agricultural engineers, coming as it does from the recognized "headquarters" of agricultural research in this country.

While it must be recognized that the field of agricultural engineering research has scarcely been scratched and that there is a need for agricultural engineers being very much alert and more aggressive along these lines, the fact remains that in this professional group there is a deep sense of the importance of research and moreover a determination to promote it in every possible way. A reasonably good start has been made, an open road lies ahead, and the need for agricultural engineers being alert to every opportunity to develop research in this field cannot be too strongly emphasized.

Sales Engineering in Agriculture

"WE ARE making a survey and business set-up that will answer the question of the advisability of installing power equipment on a given farm. We take the stand in our organization that the purchase of modern farm equipment has passed the stage of piecemeal buying and that it must be incorporated on a farm in accordance with a completed plan and system, if it is to be made a profitable investment. What we are attempting to do is to show that it is possible for men familiar with modern farm machinery, who know farm management, to go onto the agricultural plant and size it up from the standpoint of its needs for modern equipment, just as the industrial engineer sizes up the manufacturing plant to determine the feasibility of installing new equipment and junking the old."

The foregoing statement is made by a prominent consulting agricultural engineer and is of particular significance to the agricultural engineering profession.

Does this not suggest the possibility of a most interesting development in equipping agricultural enterprises? In the manufacturing industries it is quite the common thing for the management, say, with an equipment problem, to call in the sales engineers of concerns whose products are applicable to the needs, have them study the problem in hand and make recommendations. In such cases the sales engineer feels greatly the responsibility, not only to his own company, but also his prospective customer. In addition to selling machinery he is rendering an important engineering service to his client.

As the size of individual farm enterprises increase or as the operation of a few or many farms under one management increases—and both phases of this development seem to be inevitable—may we not look forward to a similar situation taking place with respect to the sale of agricultural equipment, as has come about in the sale of a great deal of equipment to manufacturers? In other words, the time may come when farm equipment manufacturers, especially in the case of the large purchasers, will sell direct to the agricultural industry, with the sales agricultural engineer not only making the actual sale of the quipment, but at the same time rendering an important engineering service to the customer, particularly in the direction of selecting the proper kind and amount of equipment to meet the given requirement or to replace worn-out or obsolete equipment with products of latest design and higher efficiency.

It cannot be very well said that such a development cannot or will not take place in agriculture. It has come about in manufacturing and there is good reason to believe that it is applicable to agriculture as well.

Another Service of Electricity

"ONE of the unfortunate occurrences in agriculture up to the present day has been the constant retirement of the older and best established farm families. This movement has continued because these people did not realize that the conveniences of a modern home could be as easily installed and as much enjoyed on the farm as in the average town, or because the women were worn out from the drudgery of those household duties which should have been lightened by labor-saving equipment and electrical appliances. Everyone interested in agriculture should encourage and aid the development of electrical power and the building of high-tension lines into farming communities, because this makes possible the use of labor-saving and automatic devices to lighten farm chores and to give home comforts."

The foregoing is a statement made in an address before the annual convention of farm equipment manufacturers last month by Roy Johnson, the owner and operator of Wandaroy Farm in North Dakota.

Along with the drift of population from farm to city there has no doubt been, for the good of agriculture, too many of the best farm families leaving the farm, for reasons which Mr. Johnson points out. If electricity will contribute to keeping the kind of people on the farm who ought to remain there, it will render an outstanding service to agriculture and to the nation. It is not that we want more people on the farm, or that we should check the flow of population from the farms to villages and cities—we who are in sympathy with agriculture want to see the most progressive and the highest type of our agricultural population remain on the farms.

Who's Who in Agricultural Engineering

E. R. Jones

G. W. Iverson

W. G. Kaiser

R. H. Black

E. R. Jones

Edward Richard Jones (Mem. A.S.A.E.) has been professor and chairman of the department of agricultural engineering at the University of Wisconsin since 1918, and also state drainage engineer since 1919, when that office was first created in Wisconsin. Born, raised and educated in the state, he received his bachelor's degree from the University of Wisconsin in 1905. Accepting the position of specialist in soil physics and land drainage at the University, he earned his master's degree by 1908. In 1911 he took leave to travel in Europe to study drainage conditions and methods there. When, in 1913, the position of advisor to all drainage organizations in the state was created, that job was added to his other duties. It lead to his appointment as state drainage engineer in 1919. The Wisconsin State Drainage Association was organized in 1914. He has served continuously as its secretary and the editor of its annual reports. He is also a member and a past-president of the National Drainage Congress. In 1918 he and his drainage work were transferred from the department of soils to the department of agricultural engineering. In the Society he has been a member of the Council and chairman of the Reclamation Division. He is now on the Membership Committee and the Advisory Committee of the College Division.

G. W. Iverson

George William Iverson (Mem. A.S.A.E.) is divisional sales manager of the Advance-Rumely Thresher Company. On receiving his bachelor's degree in agricultural engineering at Iowa State College in 1914, he became an instructor in that department. For a year following the middle of 1916 he was farm engineering editor of the Orange Judd publications. Leaving that position to enlist in the army, he spent more than two years in the American Expeditionary Forces. Upon entering civil life again in 1919 he established his connection with the Advance-Rumely Thresher Company. From his first position as service engineer for the company he was promoted to advertising manager in 1920 and later to his present position. In 1920 he also received from Iowa State College his professional degree in agricultural engineering. A member of the Society since 1916, Mr. Iverson has been active in the affairs of the Power and Machinery Division and of the Society as a whole. He was a member of the Council for three years, 1922-24, inclusive, and chairman of the Power and Machinery Division in 1926-27. He has also served on the Standards Committee, Meetings Committee, various committees of the Power and Machinery Division, and on the Publications Committee, of which he is at present a member.

W. G. Kaiser

William George Kaiser (Mem. A.S.A.E.) is agricultural engineer and assistant manager in charge of all farm promotion activities of the Cement Products Bureau, Portland Cement Association. Receiving his bachelor's degree in agricultural engineering from Iowa State College in 1924, Mr. Kaiser immediately accepted a position as assistant agricultural engineer for the Iowa Agricultural Experiment Station. In 1917 he became agricultural engineer for the Portland Cement Association, which position he held until 1921 when he was promoted to his present position. During this time, in 1919, he was granted a professional degree in agricultural engineering by Iowa State College. Becoming a member of the Society in 1917, Mr. Kaiser has been one of the most active men in the organization. After several important committee appointments he was elected first vice-president for the year 1921. The following year he became chairman of the newly organized Structures Division. He held this chairmanship for three successive years and was again appointed to it for the year 1927-28. While at the experiment station, Mr. Kaiser was co-author with Prof. John M. Evvard of a bulletin, entitled "Handy Equipment for Hog Raising," and with Prof. Evvard and Prof. J. B. Davidson, of another bulletin, entitled "Community Hog Houses."

R. H. Black

Robert H. Black (Mem. A.S.A.E.) is senior grain marketing specialist of the U. S. Department of Agriculture, in charge of grain investigations in the spring wheat area. He is also a consulting specialist in grain cleaning. Many of the recent improvements on grain clearing methods have been made through his cooperation. Since receiving his degree from Upper Iowa University in 1913 he has been continuously associated with grain cleaning work. Although engaged in the commercial wheat, grain and milling business until 1918, his interests have always been in research work. In this his commercial training and actual farming experience have proven valuable. A member of the Society since 1921, Mr. Black has become an authority and the leader of its activities in matters relating to grain cleaning. In 1923 he requested the appointment of a committee on grain handling, harvesting and drying, on which he served three years as chairman. Mr. Black is author of several bulletins and other publications of the U. S. Department of Agriculture; of more than a hundred special articles on improved methods and machinery for cleaning and handling grain; and of numerous contributions to AGRICULTURAL ENGINEERING. His papers and reports before meetings of the Society are noted. One of them was published by fifty-eight papers of national distribution.

A. S. A. E. and Related Activities

Dairy Machinery Program Announced

A DAIRY machinery meeting arranged by the Committee on Dairy Equipment and sponsored by the Pacific Coast Section of the American Society of Agricultural Engineers will be a feature of particular interest to engineers at the coming Pacific Slope Dairy Show to be held on Thursday, November 22, at the Civic Auditorium, Oakland, Calif. Following is the program:

Forenoon Session

1. "Refrigeration for the Small Dairy Farm"—H. A. Jones. Creamery Package Co. Discussion led by Dr. J. J. Frey, Golden State Milk Co.
2. "Cold Storage Box Construction for Dairy Farms"—Geo. H. Freear, VanFleet Freear Co. Discussion led by H. R. May, Edwards Ice Machine Co.
3. "Factors Which Affect the Capacity of Refrigeration Machines"—W. W. Sandholt, manager, York Ice Machinery Corp.
4. "Results of Tests of Dairy Coolers"—B. D. Moses and J. R. Tavernetti, division of agricultural engineering, University of California.

Afternoon Session

5. "Dairy Machinery from the Standpoint of the Plant Manufacturer"—G. K. Benkendorf, manager, Milk Producers' Ass'n. of Central California. Discussion led by A. Jensen, designing and consulting engineer, Los Angeles.
6. "Arrangement and Cost of Equipment for Dairy Plants"—Dr. E. S. Guthrie, dairy department, Cornell University. Discussion led by A. J. Cowell, manager, Creamery Package Co.
7. "Application of Engineering to Dairy Production"—H. B. Walker, head of the department of agricultural engineering, University of California. Discussion led by E. C. Voorhies, department of agricultural economics, University of California.
8. "Water Softeners for the Dairy Plant."—H. Aldworth, manager, The Permutit Co.
9. "Paints and Their Use in the Dairy Plant"—Howard E. Bennett, chief chemist, Sherwin-Williams Co.
10. "Machine-Cut Steel Gears and Anti-Friction Bearings for Dairy Machinery"—Harvey Feldmeier, chief engineer, Cherry-Burrell Co.

This, the second meeting of its kind, is an important step in the program of the Committee on Dairy Equipment to promote the application of engineering to the dairy production and manufacturing phases of agriculture.

Annual Meeting Plans Aired at Southwest Section Meeting

MEETING in Oklahoma City on September 29 the Southwest Section of the American Society of Agricultural Engineers heard the plans for the coming annual meeting of the Society at Dallas, direct from Dan Scoates, chairman of the Meetings Committee.

New considerations, new problems, new attitudes, in fact, a new South in the making, will be shown to the Society at the 1929 annual meeting. Cotton production and erosion control are already slated to receive generous attention. Further plans have not been released for publication as yet.

The other big interest of the Section program was rural electrification. J. E. Waggoner of Texas A. & M. College and Roy Hayman of the Oklahoma Gas and Electric Company talked on the subject. The nominating committee also met and nominated candidates for offices in the Section for the coming year.

Program for Power and Machinery Division

THE following is the program of the Power and Machinery Division meeting of the American Society of Agricultural Engineers to be held at the Hotel Sherman, Chicago, December 4 and 5:

December 4 — All Day

1. "Present Status and Trend of Large Scale Farming"—
   - (a) "Some Economic Issues of Large Scale Farming"—E. G. Nourse, chief, agricultural division, Institute of Economics
   - (b) "The Organization of Farms for Modern Machinery"—D. Howard Doane, president, Doane Agricultural Service
   - (c) "Ten Years' Experience in Manufacturing Wheat on 100,000 Acres"—Thomas D. Campbell, president, Campbell Farming Corporation
   - (d) "Group Management of Corn Belt Farms"—J. M. Dowell, general manager, Do-Well Agricultural Service
   - (e) "Large Scale Farming in Illinois"—J. Ward Nelson, farm manager, Midwest Canning Corporation
   - (f) "Results of Studies of the Economics of Large Scale Farming"—M. L. Wilson, head of the department of agricultural economics, University of Montana
   - (g) "Some Recent Observations on the Development of Large Scale Farming"—P. S. Rose, editor, "The Country Gentleman"
   - (h) General Discussion
2. "Development of a Hay Drier and Its Use on Eastern Farms"—J. H. Fulmer, owner, Green Acre Farms (Pennsylvania)

December 5 — Forenoon

1. SYMPOSIUM—"Latest Developments in Combine Harvesting and Grain Drying"—

   (The entire half-day session will be devoted to the presentation of reports on new developments in combine harvesting and grain drying during the past season from twelve states, reports of two federal studies, two reports of Canadian investigations, and a review of recent improvements in combine harvesting equipment by representatives of combine manufacturers.)

   - (a) "U.S.D.A. 1928 Combine and Grain Drying Studies"—W. M. Hurst, division of agricultural engineering, U. S. Department of Agriculture.
   - (b) "Drying Grain with Heat"—H. W. Riley, Cornell University.
   - (c) "Recent Experiment in Drying Grain"—R. I. Shawl, University of Illinois.
   - (d) "Moisture Contents of Grain"; "Drying Grain with Natural Flue Ventilation"—D. C. Heitshu, Virginia Polytechnic Institute.
   - (e) "Combine Under Adverse Weather Conditions"; "Cost of of Combine Harvesting"—F. C. Fention, Kansas State Agricultural College.
   - (f) "Pick-Up Attachment"; "Harvesting Soybeans with Combine"—I. D. Mayer, Purdue University.
   - (g) "Windrow Method of Combine"—A. J. Schwantes, University of Minnesota.
   - (h) "Field Moisture Studies on Grain Before Combining"—H. B. Josephson, Pennsylvania State College.
   - (i) "Harvesting White Beans with Combine"—H. H. Musselman, Michigan State College.
   - (j) "Cleaning 'Combined' Grain"—R. H. Black, grain investigations division, U. S. Department of Agriculture.
   - (k) "Field Problems in Combine Harvesting"—J. Fletcher Goss, formerly South Dakota State College.
   - (l) "Relative Efficiency of Three Methods of Harvesting"—J. K. MacKenzie, Dominion Experimental Farms, Saskatchewan.
   - (m) "Grain Loss Tests"; "Harvesting Soybeans with Combine"—M. M. Jones, University of Missouri.
   - (n) "The Combine in the Prairie Provinces"—E. A. Hardy, University of Saskatchewan.
   - (o) "Harvesting Flax with the Combine"—H. E. Murdock, University of Montana.
   - (p) "Combine Harvesting Experiment in Idaho"—Hobart Beresford, University of Idaho.
   - (q) "Recent Engineering Developments in Combines and Combine Equipment"—
     - (1) John Mainland, Advance-Rumely Co.
     - (2) C. D. Kinsman, Western Harvester Co.

2. "Status of Corn Borer Control by Mechanical Means"—C. O. Reed, professor of agricultural engineering, Ohio State University

December 5 — Afternoon

1. SYMPOSIUM: "The Requirements of the General-Purpose Tractor"—Led by D. C. Heitshu, assistant agricultural engineer, Virginia Agricultural Experiment Station
   Prepared discussions
   General discussion
2. "Studies of Applying Power to Soil Pulverization"—J. B. Davidson, professor of agricultural engineering, Iowa State College
3. "Use of Machinery in Weed Control"—A. J. Schwantes, assistant professor of agricultural engineering, University of Minnesota

Program of Rural Electric Division Meeting

THE following is the program of the meeting of the Rural Electric Division of the American Society of Agricultural Engineers to be held at the Hotel Sherman, Chicago, in December:

December 6 — Forenoon

1. "Farmstead Wiring"—H. S. Hinrichs, rural service engineer, Kansas Power and Light Company
2. "Wiring of Farm Buildings"—C. W. Abbott, electrical engineer, Rome Wire Company
3. "Motor Installations"—J. W. Savage, engineer, General Electric Company
4. "Installation of Water Systems"—F. W. Duffee, associate professor of agricultural engineering, University of Wisconsin

December 6 — Afternoon

1. "Feed Grinding on the Farm"—E. R. Meacham, manager, rural service department, Wisconsin Power & Light Company
2. "Dairy Refrigeration Equipment and Use"—M. B. Cann, vice-president, Eastern Sales Corporation
3. "Retail Dairy Refrigeration"—Truman E. Hienton, project leader in rural electrification, Purdue University
4. "Seed Corn Testing"—E. W. Lehmann, professor of farm mechanics, University of Illinois
5. "Ventilation by Electric Fans"—H. F. Nesbitt, Minneapolis branch manager, Ilg Electric Ventilating Company

December 7 — Forenoon

Round table discussions are being arranged for the special benefit of groups attending the meeting of the Rural Electric Division on December 6. The following round tables are being arranged for:

1. Rural Load Building by Merchandising—Led by C. P. Wagner, rural service engineer, Northern States Power Company
2. Demonstrations and Exhibits—Led by Richard Boonstra, agricultural engineer, Public Service Company of Northern Illinois
3. Silo Filling
4. Grain and Feed Elevators
5. Planning Program for June Meeting of Rural Electric Division

Program of the Structures Division Meeting

THE program of the meeting of the Farm Structures Division of the American Society of Agricultural Engineers to be held at the Hotel Sherman, Chicago, December 6, 1928, is as follows:

Forenoon Session — December 6

1. "The Dairy Barn from a Manufacturing Point of View"—H. B. White, associate professor of agricultural engineering, University of Minnesota
2. "Development in Heat-Treated Aggregates"—T. H. Merriam, cement products bureau, Portland Cement Association
   Discussion—Led by E. C. Kerth, secretary-engineer, Hollow Building Tile Association
3. "Studies on the Cost of Storing Grain"—(Speaker to be selected)

Afternoon Session — December 6

1. "The Need for Standardized Practices in Relation to Farm Building Construction"—Frank P. Cartwright, chief engineer, National Lumber Manufacturers Association
   Discussion—Led by Fred C. Fenton, professor of agricultural engineering, Kansas State Agricultural College
2. "Present Status of Research in Farm Structures"—Henry Giese, assistant agricultural engineer, Iowa Agricultural Experiment Station
3. Business session to discuss future activities of the Division

Kable to Direct National Rural Electric Project

THE establishing of the National Rural Electrification Project to demonstrate more completely and extensively the possibilities in the application of electricity to agriculture than ever attempted before called for the appointment of an outstanding figure in rural electrification development as project director. The man picked for this job was George W. Kable, agricultural engineer of the Oregon Agricultural Experiment Station, and for several years project director for the Oregon Committee on the Relation of Electricity to Agriculture. Mr. Kable took up his new duties on November 1.

Mr. Kable has been one of the more active members of the rural electrification project leaders group, and his selection to head the national project was indeed a happy one.

The National Rural Electric Project is located at College Park, Maryland. The leading sponsors of the project are the U. S. Department of Agriculture, the Committee on the Relation of Electricity to Agriculture, the National Electric Light Association, the University of Maryland, farm organizations, women's organizations, and electric power companies of Maryland. The conduct of the project is to be under the joint direction of the National Committee on the Relation of Electricity to Agriculture and the Maryland committee.

Personals of A.S.A.E. Members

I. P. Blauser, field engineer and secretary of the Ohio Committee on the Relation of Electricity to Agriculture, was married Saturday, October 6, to Miss Jean Christy of Champaign, Illinois. They will be at home in Columbus after November 15.

E. C. Easter, chief agricultural engineer, Alabama Power Company, calls attention to a booklet, entitled "Electricity Serves the Farm," just issued by that company in its effort to further promote the extension and use of electric service to farmers within the state.

J. Fletcher Goss, who recently resigned as assistant professor of agricultural engineering, South Dakota State College, to take charge of agricultural sales of Caterpillar tractors and Holt combines for the Western Material Company, of Sioux Falls, South Dakota, has been released by the latter company to become associated with the Caterpillar Tractor Company, Peoria, Illinois, in sales training work.

Max G. Hoagland, of the Illinois Power and Light Corporation, has been made supervisor of the rural electrification department of the company at Champaign.

P. B. Potter, formerly assistant professor of agricultural engineering at Ohio State University since 1916, has accepted a position in the agricultural engineering department of Virginia Polytechnic Institute. He will have charge of the work of the department in drainage and surveying, farm utilities, and household engineering.

C. E. Ramser, senior drainage engineer, of the U. S. Department of Agriculture, will present a paper on terracing at the annual meeting of the American Society of Agronomy at Washington, D. C., on November 23.

C. O. Reed and **E. A. Silver**, members of the agricultural engineering staff of the Ohio State University, are authors of a bulletin, entitled "Plows and Good Plowing (with Special Reference to European Corn Borer Control)" just issued by the Ohio State University Agricultural Extension Service. The bulletin was prepared in cooperation with the Bureau of Entomology of the U. S. Department of Agriculture.

New A.S.A.E. Members

Forrest D. Banning, rural electrification engineer, Florida Power & Light Co., Miami, Fla.

Ralph T. Filson, teacher of agriculture, Washington Union High School, Fresno, Calif.

Aubrey Lee Sharp, assistant to agronomist, Tela Division, United Fruit Co., Tela, Honduras, Central America.

Alfred J. Van Schoick, rural service specialist, New York Power & Light Corp., New York.

Applicants for Membership

The following is a list of applicants for membership in the American Society of Agricultural Engineers received since the publication of the October issue of AGRICULTURAL ENGINEERING. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

James C. Cherry, planter, Dockery, Miss.

Walter D. Ellison, assistant drainage engineer, U. S. Department of Agriculture, Fort Wayne, Ind.

Ernest B. Kellogg, farmstead engineer, National Lumber Mfgs. Ass'n., New York, N. Y.

Charles A. Logan, research engineer, Colorado State Agricultural College, Fort Collins, Colo.

Erling Styri, professor, The Norway College of Agriculture, As, Norway.

Harold G. Wilson, engineer, Timken Roller Bearing Co., Chicago, Ill.

Transfer of Grade

D. Cromer Heitshu, assistant agricultural engineer, Virginia Agricultural Experiment Station, Blacksburg, Va., (Junior to Associate Member.)

Employment Bulletin

This service, conducted by the American Society of Agricultural Engineers, appears regularly in each issue of AGRICULTURAL ENGINEERING. Members of the Society in good standing will be listed in the published notices of the "Men Available" section. Non-members as well as members, are privileged to use the "Positions Open" section. Copy for notices should be in the Secretary's hands by the 20th of the month preceding date of issue. The form of notice should be such that the initial words indicate the classification. No charge will be made for this service.

Men Available

AGRICULTURAL ENGINEER available. Seventeen years experience in the designing and manufacture of farm tractors, motor trucks, harvesting machines, and earth-working tools. Sales experience in United States, Canada, England, France, and Italy. Write for interview. MA-132.

AGRICULTURAL ENGINEER, graduate of Colorado Agricultural College in civil and irrigation engineering, with sixteen years experience in irrigated agriculture and land reclamation, desires position, preferably on the Pacific Coast. MA-154.

AGRICULTURAL ENGINEER desires position as general manager of large agricultural concern where initiative, ability and resourcefulness are required. Has knowledge of legal procedure and finance, has handled agricultural propositions employing three thousand men, speaks Spanish, recently carried out reorganization in Latin America for one of the largest banks in this country. Can furnish credentials as to character, integrity and sobriety. 40 years of age, excellent health, American native born, protestant, married. Will go anywhere but prefers continental U.S.A. MA-148.

AGRICULTURAL MACHINE DESIGNER, age 38, seeks larger opportunity. A graduate in mechanical engineering, with five years of machine shop practice and mechanical drafting, and ten years in experimental department of a large agricultural implement organization manufacturing a full line of tillage and harvesting tools. Experience at bench, floor, field work and drafting. Capable of handling men. MA-155.

Positions Open

AGRICULTURAL ENGINEER with college training and practical experience with tillage tools and seeding machinery wanted by a farm machinery manufacturer in the Middle West. Must be skilled draftsman and have designing ability. PO-132.

AGRICULTURAL ENGINEER wanted for position as teacher of farm machinery in a southern agricultural and mechanical college. Salary about $3000. Position has excellent opportunities. PO-135.

SERVICE MANAGER to organize field service, prepare instruction books, and repair parts list is wanted by power farming machinery manufacturer. Must be loyal, aggressive, and able to handle service men, dealers, and customers. Give full details of training, experience, references, etc., in first letter. PO-136.

MECHANICAL ENGINEER wanted by power harvesting machinery company in the middle west. Must be aggressive, loyal, ambitious, and capable of handling drafting room. Also must be able to cooperate with manufacturing department. State training and experience in first letter. PO-137.

MANAGER AND EXECUTIVE wanted to undertake the direction and execution of an agricultural development of 6,000 acres of land in Florida. Position calls for a man of wide experience in production of products which are possible to Florida and one whose practical experience is backed up by a reasonable amount of scientific knowledge. He must be a man whose reliability and integrity are beyond question and whose executive ability is of a high order. He must further have the faculty of doing things at the least possible cost. PO-139.

DESIGNERS AND DRAFTSMEN wanted. One of the leading farm equipment manufacturers is increasing its engineering personnel and desires to secure the services of two or possibly three designers and draftsmen, preferably those who had had tractor, implement, or allied experience. PO-140.

PRACTICAL FARMER wanted to team up his experience and labor with the land and operating capital of a farm owner in Guatemala. Prefer married man about thirty years of age, one who understands the raising of corn, wheat, garden truck, etc., and who also understands tractors and other farm machinery and can utilize modern equipment in a modern way. Traveling expenses can be advanced and ample farm operating funds provided. Profits split fifty-fifty. Write fully giving age, education, experience; send photograph. PO-141.

MECHANICAL FIELD REPRESENTATIVE for sales department wanted by a leading manufacturer of farm equipment. Will have charge of field organization throughout the company's branch house territory. As the work will be mostly in the Southern states a man familiar with Southern conditions is desired. Must possess qualifications to deal with salesmen as well as having engineering ability. PO-142.

AGRICULTURAL ENGINEER wanted to assist in teaching general agricultural engineering subjects, preferably one qualified along farm machinery lines. Should be qualified to take freshmen in a three credit course, stressing mechanics, electricity, hydraulics, etc., in as practical a way as possible. Minimum salary, $2400. This can be increased if right man is located. Address W. J. Gilmore, professor of farm mechanics, Oregon State Agricultural College, Corvallis.

AGRICULTURAL ENGINEER with a degree in agricultural engineering wanted to fill a vacancy in an agricultural engineering department of one of the state agricultural colleges of the Northwest. The work will be entirely in farm power and machinery, time being given about half and half to teaching and research. PO-143.

AGRICULTURAL ENGINEER wanted for instructor in farm buildings and conveniences or farm machinery. Farm and practical experience desired. Salary $2400 to $2800. Applicant should furnish personal and service record. PO-144.

AGRICULTURAL ENGINEER wanted in sales promotion division of an internationally known tractor company. Young man just out of college last June and with two or three-months' experience in the field preferred. Work will include compiling field data for use in sales work, the handling of demonstrations and fair exhibits, and the other usual work connected with sales promotion. Privilege of starting the work any time between now and the first of January. PO-145.

ENGINEER with designing and drafting experience on combines, threshers and tractors, wanted by a progressive farm machinery manufacturer in the Middle West. Only men with first-class experience need apply. PO-146.

AGRICULTURAL ENGINEER wanted by an Agricultural College in the East as instructor in farm motors and machinery with some opportunity for research work. PO-147.